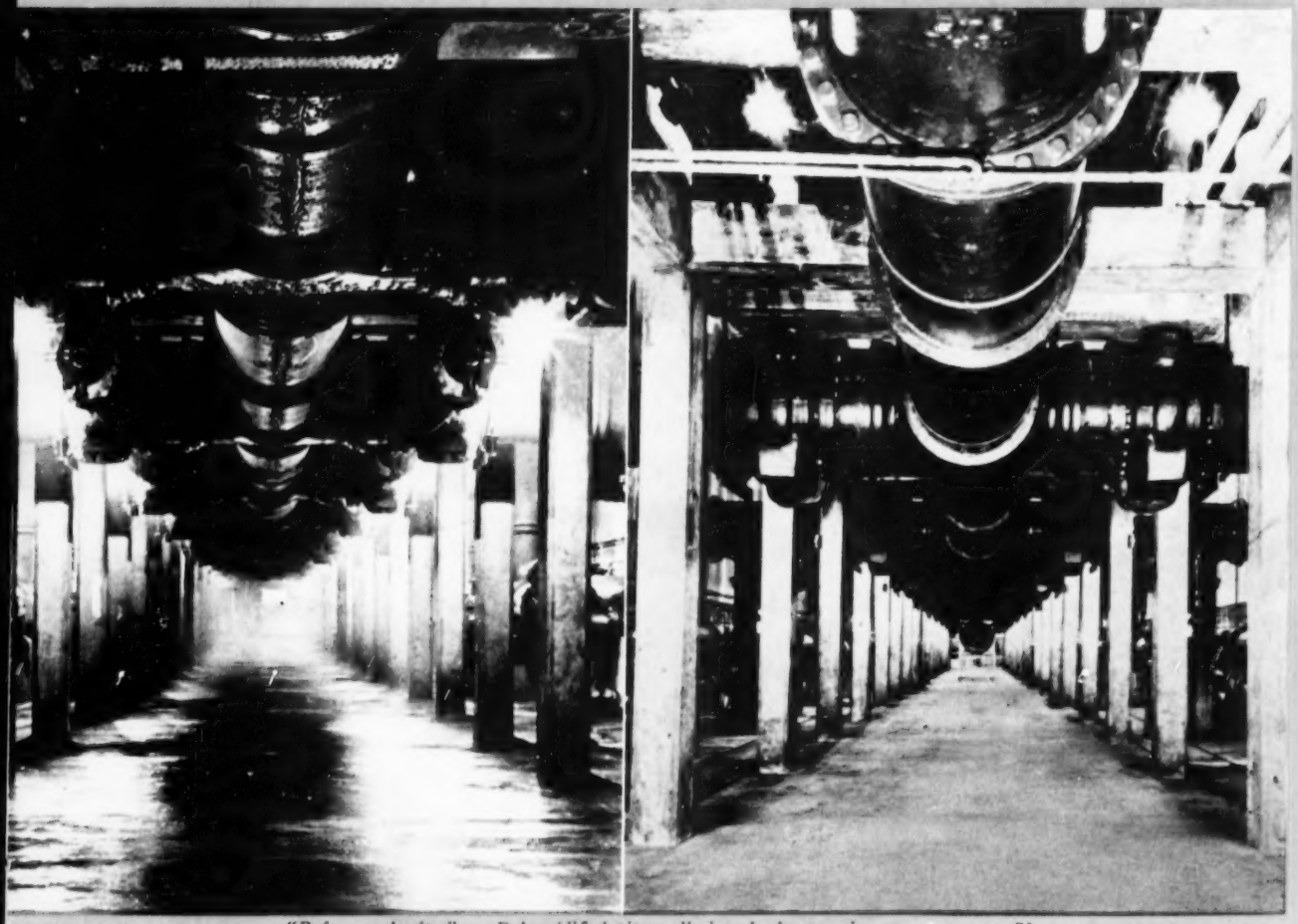
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

FEBRUARY ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 109—Journal Section of The American Society of Heating and Ventilating Engineers



"Before and after" — Dehumidified pipe galleries check corrosion ..... page 73

Pressurizing HPHW Systems 84

Air Conditioning Airport Terminal Building ...79

Heat Relief in Industry ..90

Complete Contents of This Issue 5

MANY POPULAR DEPARTMENTS .... Pages 65, 69, 102, 105, 106, 107, 108 and others

ADJUSTABLE PIPE HANGERS AND SUPPORTS

for every piping requirement

NO. 4 OF A SERIES SHOWING THE GRINNELL LINE

BRACKETS, HOOKS, CLAMPS for attachment to walls, columns and beams

Light Welded Steel Bracket
fig. 194
max. load: 750 lb.

Medium Welded Steel Bracket
fig. 195, max. load: 1500 lb.
heavy welded steel bracket
fig. 199, max. load: 3000 lb.

Side Beam Bracket
fig. 202
load: 150 to 2300 lb.

Side Column Bracket
fig. 203
load: 150 to 390 lb.

Cast Iron Bracket
fig. 223
load. 610 lb.

Cantilever Bracket
fig. 221
with angle iron ext.
fig. 222

Single Hook
fig. 168
½ to 3 IPS

One Hole Clamp
fig. 126
⅜ to 4 IPS

FLANGES, CLIPS, HOOKS for attachment to the ceiling

Adj. Swinging Hanger Flange
fig. 155, for ⅜ to ⅞ in. rod
flange only
fig. 156, for ¾ to 12 in. pipe

Swivel Hanger Flange
fig. 154
for ⅜ to ⅞ in. rod

Pipe Hanger Flange
fig. 153
for ⅜ to ⅞ in. rod

Ceiling Flange
fig. 128
for ⅛ to ¾ IPS

Adj. Clip Base
fig. 116
for ¾ to 2 in. pipe
⅜ in. rod size

Wrought Clip, Long
fig. 263
short: fig. 262
½ to 4 in. pipe

Tin Clip
fig. 231
¼ to 2 in.

U Hook
fig. 205
¾ to 8 in. pipe

Call Your Local Grinnell Distributor or write for Hanger Catalog.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

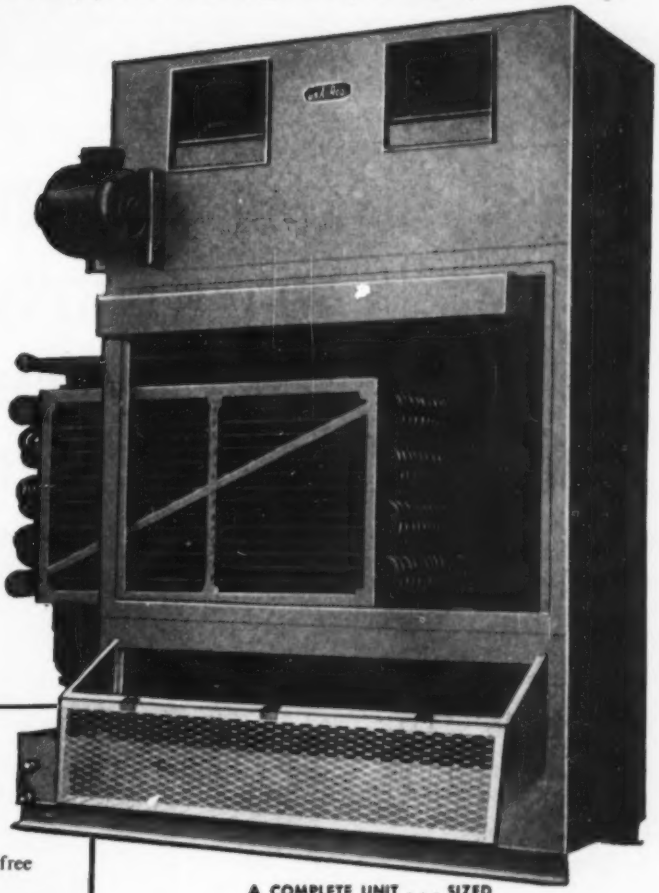
Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

NEW! Completely Redesigned usAIRco Evaporative Condenser!

UNLIMITED FLEXIBILITY BECAUSE OF BUILDING BLOCK CONSTRUCTION!

All Panels are Easily Removable... can be re-arranged quickly in the field!

Any component can be erected to face either way. Rubber gaskets between sections insure water tightness and freedom from vibration. To facilitate setting up, units may be ordered in any preferred arrangement. The usAIRco ECU assures long life, trouble-free and thoroughly effective operation.



A COMPLETE UNIT . . . SIZED FROM 7½ TO 40 TONS

A completely assembled unit, ready for operation, but may be field disassembled and reset. Constructed of heavy gauge steel with 12 gauge tank, 12 gauge end frames and 16 gauge panels.

YEARS AHEAD IN ENGINEERING FEATURES!

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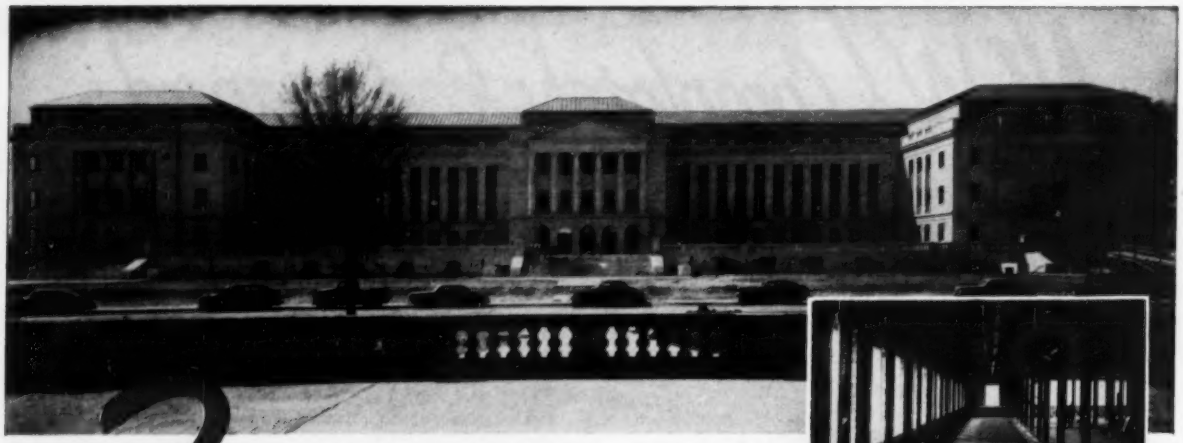
  All fabricated steel parts are assured of corrosion-free operation by hot-dip galvanizing after fabrication.
- **Surface Coil Section**
  Coil is completely bare tube type providing deeper air flow dimension, and designed for maximum heat removal for air quantity required. (Unit construction easily removes coil as an integral assembly).
- **Building Block Construction**
  Any required arrangement is possible, as blower, coil and tank sections are designed for quick changeover and re-assembly in the field.
- **Sectional Components Removable**
  All components are accessible through removable panels and can be easily removed from unit if necessary. Periodic examination of the spray section is easily accomplished by sliding metal panel doors.
- **Superior Spray Assembly**
  Spray section design provides greatest possible wetted area, with large orifice, low pressure, non-clogging nozzles. Entire section conveniently accessible for inspection and cleaning.

usAIRco

See your nearest usAIRco agent or write to Dept. HP 253

United States Air Conditioning Corporation
MINNEAPOLIS 14, MINNESOTA



2 more BIG RADIANT HEATING INSTALLATIONS

select the time-proved protection of

BYERS WROUGHT IRON PIPE

COMMONWEALTH OF KENTUCKY
CAPITOL ANNEX, Frankfort, Ky.
Architects—Meriwether, Marye & Associates
Lexington, Ky.
Engineers—Procter-Ingels Engineers Associated
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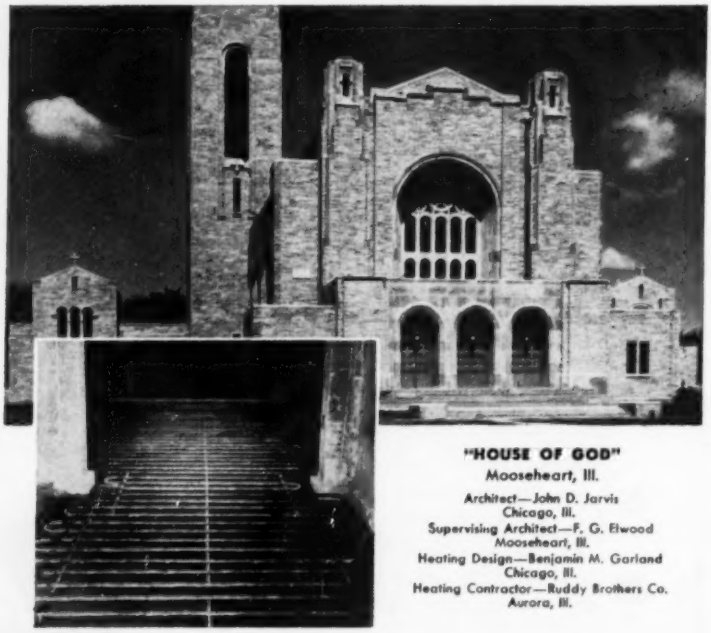
Heating Contractor—B. A. Walterman
Cincinnati, Ohio

The established and continued acceptance of Byers Wrought Iron pipe for radiant heating systems is supported by thousands of past successful applications, and is constantly being confirmed by the growing number of current installations.

The two radiant heating installations covered here are typical of the confidence today's leading engineers hold for this time-proved material. In the Commonwealth of Kentucky's new $6 million Capitol Annex more than 24 miles of Byers Wrought Iron pipe was installed to safeguard the largest radiant heating system in a public building. And in "House of God," one of the largest radiant heated churches in the country, nearly 7 miles of $1\frac{1}{2}$-inch Byers Wrought Iron pipe was laid in the church floor, steps and altars to provide the desired durability.

Write today for our bulletin, BYERS WROUGHT IRON FOR RADIANT HEATING.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N.Y.



"HOUSE OF GOD"
Mooseheart, Ill.
Architect—John D. Jarvis
Chicago, Ill.
Supervising Architect—F. G. Elwood
Mooseheart, Ill.
Heating Design—Benjamin M. Garland
Chicago, Ill.
Heating Contractor—Ruddy Brothers Co.
Aurora, Ill.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 25 No. 2

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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FEBRUARY 1953

Features

Dehumidified Pipe Galleries — 73
W. W. DeBerard

Power Project Poses Ventilation Problems — 78
Canadian development

Air Conditioning Pittsburgh Airport's Terminal — 79
Theo. F. Rockwell

Pressurizing High Pressure Hot Water Systems — 84
J. R. Kell

Flexible Tubing Helps Test Conditioners — 87
"Largest made"

Air Conditioning the White House — 88
Charles Stempf and Henry A. Caldwell

Improved Buildings an "Overlooked Phenomenon" — 89
Cost more but worth more

Heat Relief in Industry — 90
Heat shielding, evaporative cooling

Heating, Air Conditioning New Submarines — 96
Howard S. Dewey

The Fuel Situation — 98
Kalman Steiner

Heating Airplane Hangars — 100
Modifications in design

Pipe Line That Led To the Court House — 102
C. T. Baker

Room Units Need Adequate Wiring — 104
Observe these rules

Heating Offices With Plant Steam — 104
Suggested hook-up

Departments

The Editor's Pages — 65
News and notes

"Open for Discussion" — 69
Comment and criticism

Anything Can Happen — 102
Piping changes pay

Question of the Month — 105
Installing radiant heating

Data Sheet — 106
Depreciation rates for equipment

The Law and Your Profits — 107
William Hurd Hillyer

Sam Lewis' Page — 108
Heating industrial plants

Equipment Developments — 167
New and improved products

Who's What — 183
New personnel and promotions

Meetings and Conventions — 194
Calendar of coming events

New Books and Reports — 198
Helpful information

Recent Trade Literature — 203
Manufacturers offer data

Index to Advertisers — 214

ASHVE Journal Section

Cooling Small Residence With 2 Hp Unit — 109
H. T. Gilkey, D. R. Babufleth and R. W. Roose

Field Studies of Floor Panel Control Systems — 120
A. B. Algren, E. F. Snyder, Jr., and J. S. Locke

Honored by Life Membership — 132

Summary of Chapter Meetings — 134

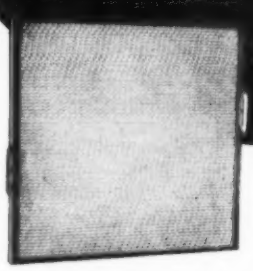
Candidates for Membership — 142

Officers, Council and Committees — 147

FLOWLINE
TRADE MARK
WELDING FITTINGS
Stainless Steels, Monel, Nickel
BRING ALL THE ADVANTAGES
OF WELDED CONSTRUCTION
TO USERS OF
CORROSION-RESISTANT PIPING . . .
More than 3000 Stock Items
FLOWLINE Welding Fittings are stocked throughout the country by leading warehouses specializing in corrosion-resistant metals, in Schedules 10, 40, and 80 (Schedule 5 also available)—sizes ½ inch through 12 inches—in stainless steel Types 304, 316, and 347; Monel, Nickel, and Aluminum.
With FLOWLINE Fittings it is practicable for users of corrosion piping to obtain the fullest economy and efficiency of simplified welded construction—in design, installation, operation, and maintenance.
Welded construction provides greatest freedom in designing the layout. The system uses less space, is lighter in weight, and can be assembled and put into service faster. It is permanently leak-proof, has greater strength, longer life, and best flow characteristics.
FLOWLINE corrosion-resistant fittings include tees, stub ends, ells, reducers, and caps. All are made of forged or wrought metals, cold formed by our exclusive process and annealed, putting the metal in the best condition for corrosion service.
WELDING FITTINGS CORP.
NEW CASTLE, PENNSYLVANIA
World's Largest Manufacturer of Stainless Welding Fittings

BANISH HIGH AIR FILTRATION COSTS!

FAR-AIR* Filters Save You Money Four Ways!



Yes, you can have more efficient air filtration at less cost when you install FAR-AIR. These are the original high velocity filters and are "lifetime engineered" for economy and top efficiency. Remember these four ways to save the next time you buy or replace air filters:

LOWER FIRST COST

FAR-AIR filters handle 50% more air per unit with less pressure loss than ordinary types. Thus two filters will do the work of three which means fewer units to buy originally plus the economy of smaller plenum chambers. Each FAR-AIR filter will handle *more* dirt and *more* air with *less* pressure loss and will give greater efficiency than other types of impingement filters.

50% LESS MAINTENANCE

Because there are fewer filters required to do your job and because of the exclusive herringbone-crimp media design which allows each filter to hold more dirt, cleaning frequency is drastically reduced—over 50%! Maintenance is faster and easier, too, because of the free flushing characteristics of the media — a great saving in time and money.

GREATER EFFICIENCY

The exclusive herringbone-crimp design of FAR-AIR filters allows the dirt to load progressively through the entire filter, not just on the face. There is exceptionally low pressure loss even on a fully loaded filter because channels in the media allow passage of clean air. This gives you more efficient filtering under all dust conditions for longer periods of time.

LONGER SERVICE LIFE

Excellence of construction protects your investment and insures that FAR-AIR filters will far outlast ordinary types. Here are some of the quality features.

Sixteen gage steel filter and holding frames assure well-aligned rigid filter banks. Reinforcing rods make distortion virtually impossible. Felt linings prevent air by-pass. Firmly packed media provides *permanent* even density and assures uniformly high efficiency over the entire filter area.

Truly, when you buy FAR-AIR filters you get more for your money *four* ways. It will pay you to investigate these filters now and cut your air filtration costs.

Other FAR-AIR Products:

Self-Washing Filters
Kitchen Grease Eliminators
Engine and Compressor Filters
Rotary (Evaporative) Coolers
Air Baffle Equipment
Filter Servicing Equipment

FAR-AIR FILTERS "Better by Farr"

*Trade Mark

FARR COMPANY
Manufacturing Engineers
CHICAGO · LOS ANGELES · NEW YORK

MFd under license by Control Equipment Co., Ltd., Montreal, Canada

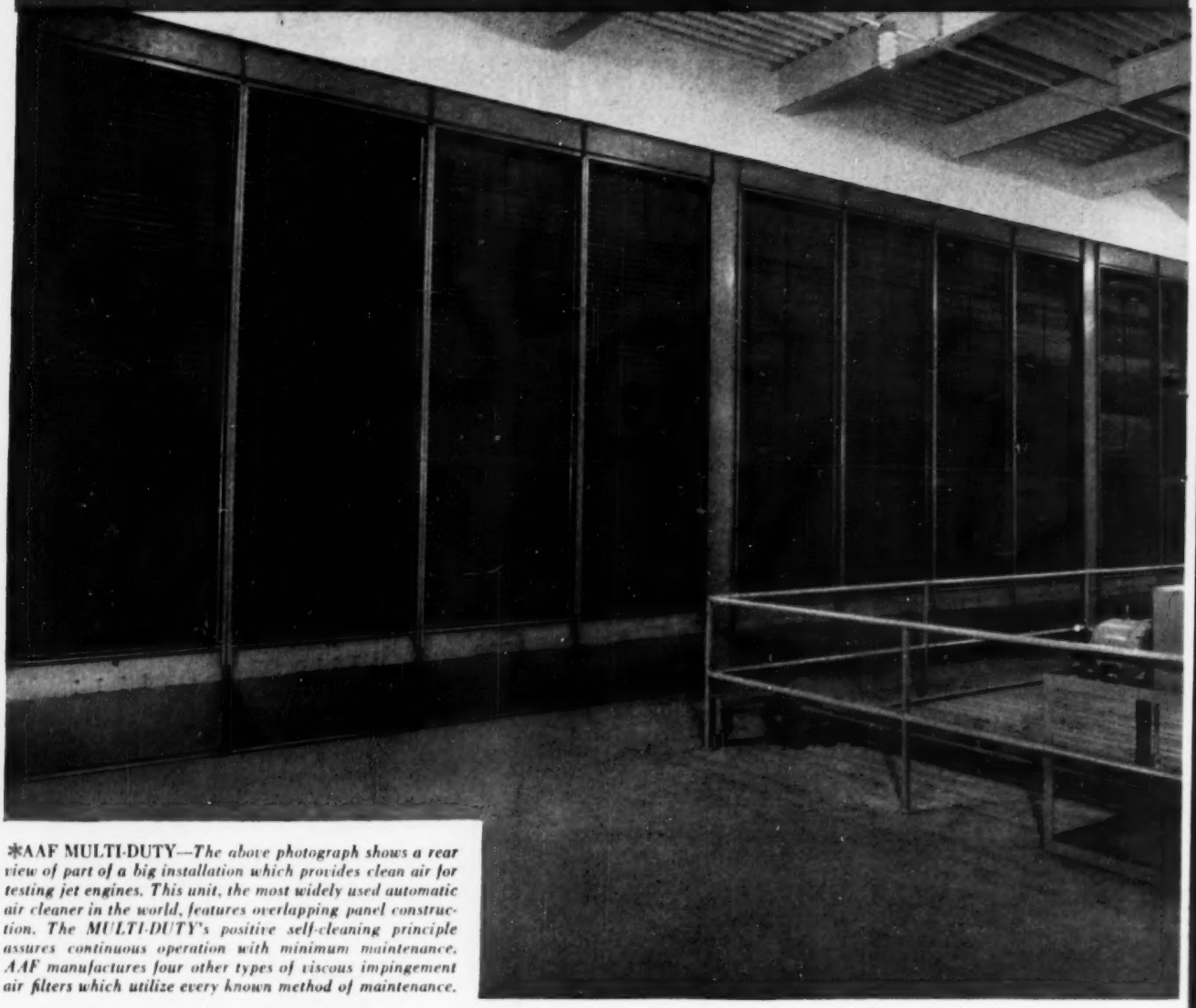
Mail this coupon today!

FARR COMPANY
P. O. Box 10187, Airport Station, Los Angeles 45, California

Gentlemen: I would like full information on FAR-AIR filters.
I would ____ would not ____ like a Farr Field Engineer to call.

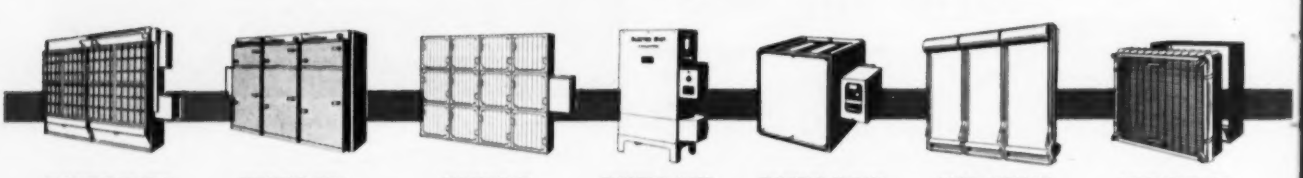
NAME _____ TITLE _____
COMPANY _____
ADDRESS _____

Why are 5 types* of



*AAF MULTI-DUTY—*The above photograph shows a rear view of part of a big installation which provides clean air for testing jet engines. This unit, the most widely used automatic air cleaner in the world, features overlapping panel construction. The MULTI-DUTY's positive self-cleaning principle assures continuous operation with minimum maintenance. AAF manufactures four other types of viscous impingement air filters which utilize every known method of maintenance.*

a single source for all air cleaning equipment . . .



ELECTRO-MATIC | ELECTRO-CELL | ELECTRO-PL | ELECTRO-MIST | ELECTRO-KLEAN | AUTO-AIRMAT | AIRMAT PL-24

viscous air filters needed?

IT'S A GOOD QUESTION since other companies only make *one* or *two* types! However, the answer makes sense to engineers! AAF's five distinct types of vicous impingement filters offer the needed latitude in specifying the right filter for a particular job. The engineer working with AAF equipment is able to easily pin-point an efficient solution to his problem with greatest economy to the user.

Each type has individual characteristics affording unequalled flexibility in combining the following factors • Cleaning Efficiency • Maintenance Methods • Space Requirements • Sizes and Air Volumes • Practical and Realistic Range of Costs.

Following are the five types of AAF viscous impingement filters:

*MULTI-DUTY—Permanent self-cleaning and fully automatic filter with exclusive overlapping panel construction.

*M/W Unit—Washable filter for heavy duty industrial service.

*HV Unit—High velocity washable filter with exclusive media design for commercial and industrial applications.

*RENU-*glas*—Low cost filter with replaceable glass filament pads in permanent metal frame.

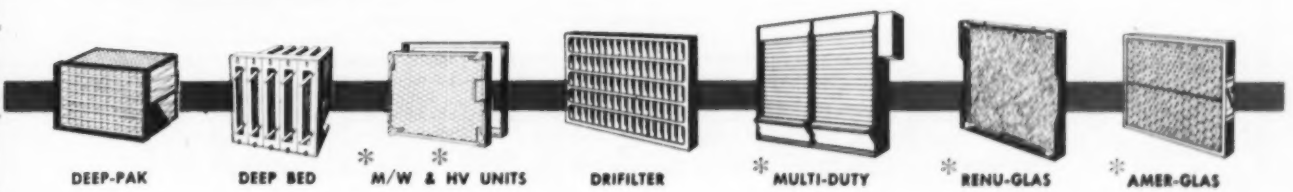
*AMER-*glas*—Throw-away filter with fine glass filament media.

In addition to a complete line of air cleaning equipment AAF also offers the services of a nationwide engineering staff, which is recognized as the leading authority in this field. The specialized knowledge of these experts can save you time, effort and expense and is at your disposal.

American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Ky.

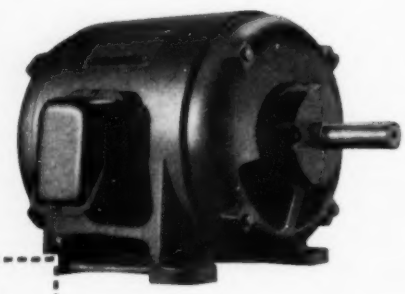
AMERICAN AIR FILTER OF CANADA, LTD., MONTREAL, P. Q.
PACIFIC DIVISION OFFICE, SAN FRANCISCO, CALIFORNIA



If Your Problem IS HERE

Between Power

ALLIS-CHALMERS



SEND COUPON

Allis-Chalmers Mfg. Company
Milwaukee 1, Wisconsin

Please send me more information on Allis-Chalmers coordinated equipment.

- ☐ Motors — Bulletin 52B6052
- ☐ Control — Bulletin 14B7132
- ☐ *Texrope* V-belt Drives — Bulletin 20B6051

Name .....

Title .....

Company .....

Address .....

City and State .....

A-3904

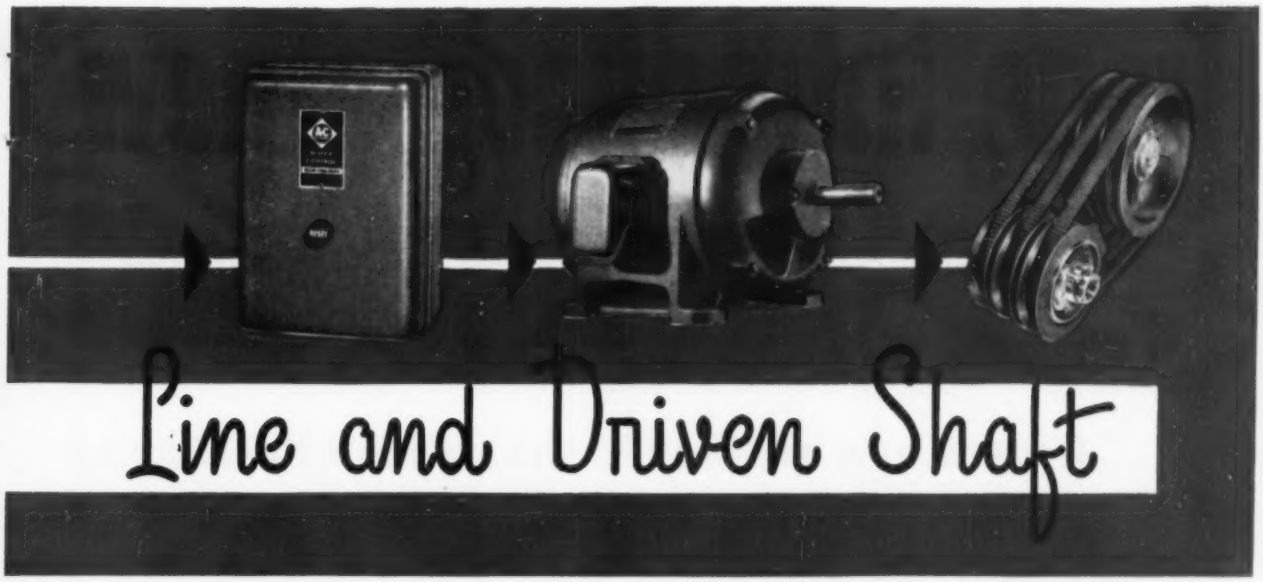
Motors — Smooth running and quiet operating. Cast iron frames resist corrosion in humid atmospheres. Double shielded bearings do not ordinarily require lubrication but may be lubricated in service if desired. Sleeve bearing motors available in many sizes if required.

Sizes from ½ hp up. Types include single and multi-speed squirrel-cage, dc, wound-rotor and synchronous. Enclosures include drip-proof, splash-proof, totally-enclosed, non-ventilated, totally-enclosed fan-cooled and explosion-proof. Totally-enclosed and explosion-proof motors built in famous finned design which greatly reduces cleaning problems and costs, or in the tube-cooled design which gives the same maintenance savings in the larger sizes.

TEXROPE Drives — The original multiple V-belt drive and the most complete line of V-belt drive products in the industry. *Super-7* V-belts feature grommet construction in all but the smallest sizes. Also available in high-capacity, oil-resisting, static-conducting type.

Variable speed sheaves for fans and pumps provide a simple, inexpensive method of controlling output. Saves time in balancing systems, simplifies seasonal adjustments. Allis-Chalmers variable speed sheaves include *Vari-Pitch* sheaves for stationary or motion control with both standard and wide range adjustments.

Constant speed sheaves include *Texsteel* sheaves and *Magic-Grip* easy mounting sheaves in a complete range of sizes.



Line and Driven Shaft

CAN HELP YOU

Control — There is an Allis-Chalmers control to meet every requirement of motor operation through the complete range of motor sizes. Manual and magnetic, reversing and non-reversing, across-the-line and reduced voltage starters are included. Push button and pilot devices are available in any number of positions and in all combinations. Accessory Allis-Chalmers control equipment includes dc contactors, timing relays, contactors for heavy duty starting and rotary control switches.

YOU CAN SAVE TIME, SAVE WORK, SAVE MONEY and be sure of your fan, pump and compressor drives when you use coordinated components from Allis-Chalmers. For Allis-Chalmers can supply you with control, motor and *Texrope* V-belt drive for your machine . . . all of integrated design and manufacture.

Unit Responsibility

By using Allis-Chalmers coordinated drive components, you save paperwork and the time and cost of matching parts from different sources. More important, you know the components will fit together properly . . , that assembly will be completed quickly and easily.

And you don't have to worry about passing the buck on service. Allis-Chalmers stands behind the complete drive and takes responsibility for the proper functioning of every part.

Delivery from Stock

Immediate delivery from stock can be had on nearly all standard items from warehouses and distributor stocks located all over the country.

Allis-Chalmers representatives are experienced in air conditioning problems and can give you the kind of help you need in selecting the best drive for your machine. And this team of field experts is backed up by a large factory engineering staff.

Certified Service

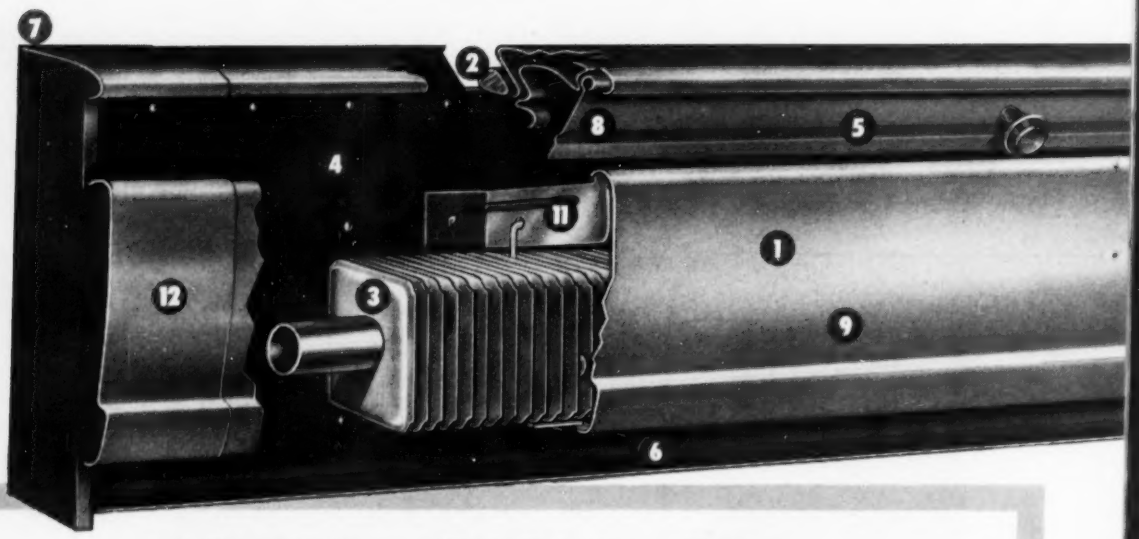
Allis-Chalmers continues to serve you after the sale with nearly a hundred Certified Service Shops located in every industrial area in the country. Allis-Chalmers Certified Service Shops are carefully selected independent service shops that use only factory-approved parts and methods in complete servicing of Allis-Chalmers equipment.

Texrope, Texsteel, Magic-Grip, Vari-Pitch, and Super-7 are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Trane introduces a new *labor-saver* Baseboard

A great new addition to the nation's No. 1 line of



Installs easier because it's built better . . . 12 ways

1. **Snap-on front** . . . no metal screws, no metal drilling
2. **Full-length back-to-wall rubber seal** . . . to prevent streaks
3. **Famous TRANE fin-and-tube** . . . copper tube, aluminum fin, mechanically bonded
4. **One-piece back and top** . . . minimum parts quickly installed, mounting holes provided
5. **Uninterrupted outlet** . . . blends unit into room
6. **Reverse radius at bottom** . . . eliminates quarter round, speeds installation
7. **Universal unit** . . . free-standing or semi-recessed . . . 2 heights, 2 capacities
8. **Snap-in damper** . . . no screws, hinges, levers or chains
9. **All parts roll and die formed** . . . to assure quick, accurate assembly
10. **Snap-on joiner pieces** . . . fit tight, completely cover joints
11. **Coil hanger** . . . allows free expansion, ends noise
12. **End caps** . . . feature snap-on fronts for easy accessibility

You can save labor and shave costs with this

beautiful new TRANE

Convector

modern radiation.

1

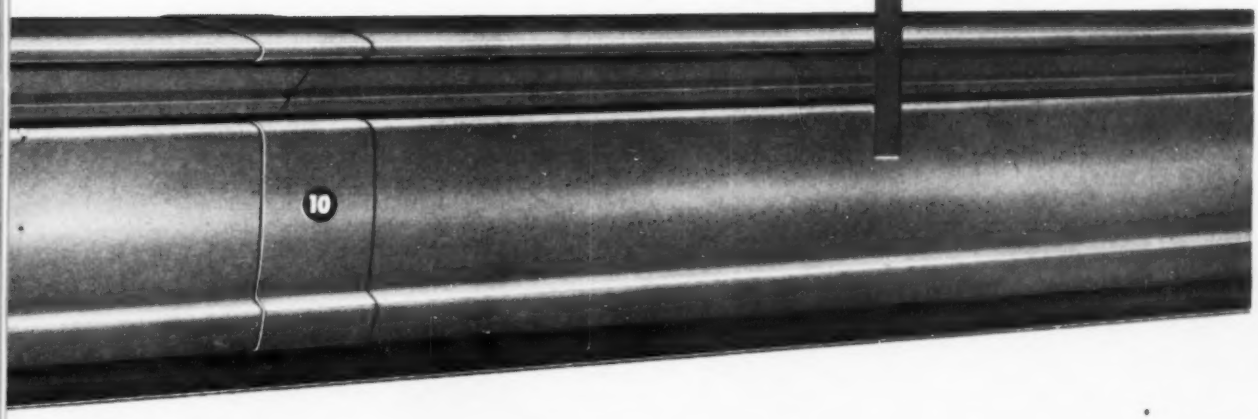
Cuts handling time 1/3

Contains fewer parts . . . arrives assembled with element mounted in cabinet. It's far easier to handle. There are no parts to sort.

2

Cuts installation time 1/2

Fit . . . connect . . . snap together. No sheet metal screws. No sheet metal drilling. No leveling. No complicated fitting.



Saves hours on the job . . . here's why:

1. Remove assembly from package!

Basic Baseboard Convector unit arrives *assembled* . . . in *one* package. Just slip it out. No sorting of parts. No complications.

2. Mount one-piece back plate!

Mounting holes are factory drilled (on 1½" centers). Hanger holes are pre-punched. No leveling, no sheet metal drilling.

3. Only two cabinet parts to trim!

A simple on-the-job operation. No complicated fitting. Only two parts . . . easily tailored to fit the job dimensions.

4. Snap on front, joiners, corners!

Snap-on joiners, corners, end pieces cover all metal edges. No special tools, no sheet metal screws. Damper snaps in.

MAIL THIS COUPON TODAY

Baseboard Convector

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn.
Trane Co. of Canada, Ltd., Toronto • 80 U.S. and 14 Canadian Offices

The Trane Company, La Crosse, Wisconsin

I would like an *advance look* at the details of the new TRANE Baseboard Convector. Please send me your FREE bulletin.

NAME_____

FIRM_____

POSITION_____

ADDRESS_____

CITY_____ STATE_____

New Texas Hospital Demonstrates Flexibility of Honeywell Customized Temperature Control

System will meet wide range of temperature control needs

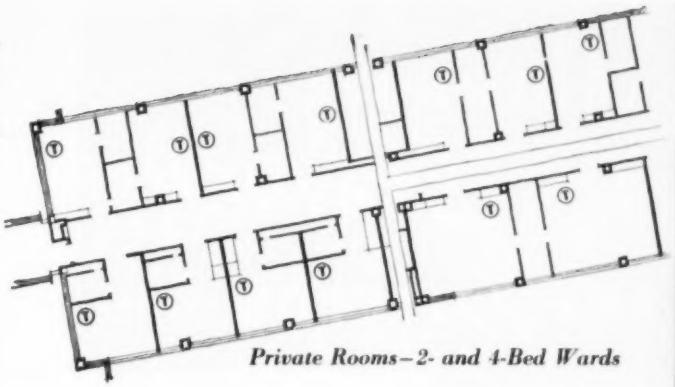
The University of Texas M. D. Anderson hospital for cancer research, now under construction in the Texas medical center at Houston, will be a truly outstanding addition to the country's medical facilities when it's completed sometime next year.

Carefully planned in every detail, this "cancer station" will contain such features as the first cobalt "bomb" in the United States for radiation treatment, color television for remote observation of operations and a betatron laboratory.

Another feature of this new building is that both heating and cooling will be controlled by Honeywell Customized Temperature Control.

The installation includes *comfort* control for patients—an individual thermostat in every patient's room. It includes operating room controls for both temperature and humidity. It includes a new electronic temperature control system to maintain photographic bath water within the exacting temperature range of plus or minus one-tenth of one degree Fahrenheit. And it includes electronic fume hood controls to remove dangerous fumes from radio isotope laboratories.

In the Anderson hospital, Honeywell Customized Temperature Control will indeed meet a wide range of temperature needs.



Private Rooms—2- and 4-Bed Wards

Notice on the floor plan that with Honeywell Customized Temperature Control each patient-room has its own individual thermostat. This means that *each* patient can be kept genuinely *comfortable* no matter what the weather outside. And it makes it possible for doctors to "prescribe" the exact temperature each patient needs to get well fast.

Plans for the Anderson hospital were developed by the following firms: MacKie & Kamrath, AIA, Architects, Houston; Schmidt, Garden & Erikson, Consulting Architects, Chicago; Lockwood & Andrews, Mechanical and Site Engineers, Houston; Walter P. Moore, Structural Engineer, Houston; Farnsworth & Chambers Co., General Contractors, Houston; Archer Plumbing Co., Mechanical Contractors, Houston.

For Comfortable, Even Temperature in New or Existing Buildings— of Any Size, Specify Honeywell Customized Temperature Control

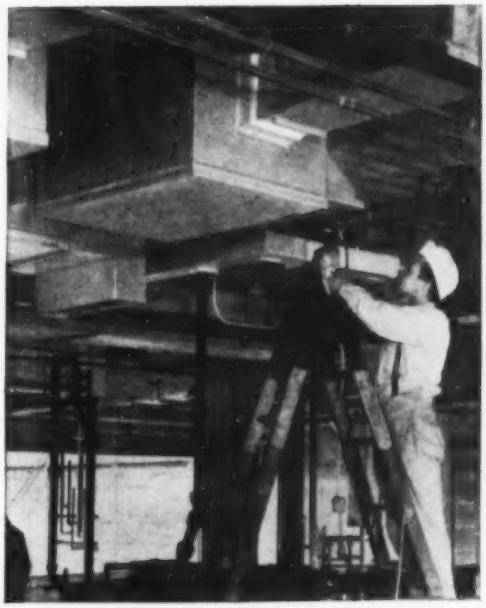
Whether it's a hospital, apartment, office, store, factory, school, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating and air conditioning problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate"—and save fuel besides.

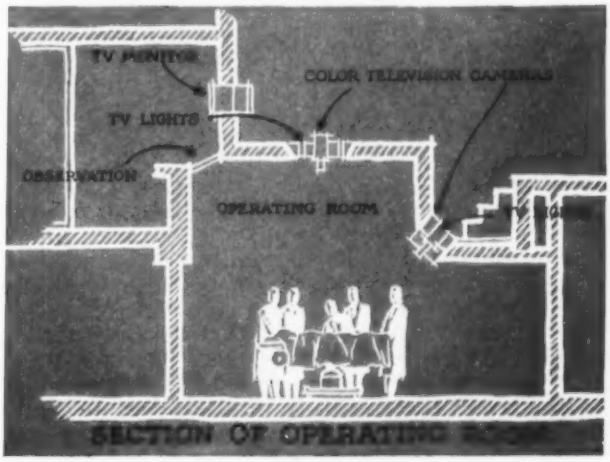
For full facts, call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

W. M. Andrews of Lockwood & Andrews, Consulting Engineers, says:

"It's an extremely flexible method of control. And that means Honeywell Customized Temperature Control can be used to meet nearly any temperature problem—in any type of building."



Honeywell Customized Temperature Control will control these air conditioning units suspended above doorways. Heating of rooms will also be thermostatically controlled. When installed *at time of construction*, system duct work can easily be concealed, can be put in at lowest cost.



Color television, as shown on the operating room cross section above, will permit over 300 students to watch surgery. Extra heat from television lights will be compensated for by sensitive Honeywell thermostats. Operating rooms will also be equipped with humidity controllers, an important feature in the Honeywell Customized Temperature Control installation.

MINNEAPOLIS
Honeywell

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-2-202, Minneapolis 8, Minnesota

Gentlemen:
I'm interested in learning more about Honeywell Customized Temperature Control.

Name _____

Firm Name _____

Address _____

City _____ *Zone* _____ *State* _____

NEW! DOLLINGER Electro-Staynew PRECIPITATOR -----

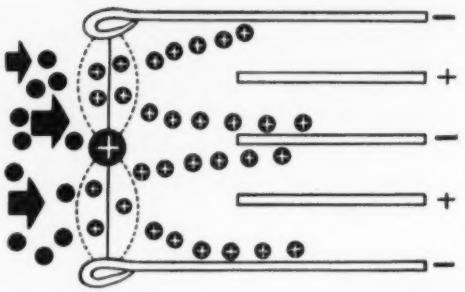
ELIMINATES SMOKE, AIRBORNE DUST AND POLLEN

IN ALL TYPES OF VENTILATING SYSTEMS

THE Electro-Staynew Precipitator is the latest addition to the complete line of Staynew Filters. More than thirty years of filter-making "know-how," and over five years of testing and improving by actual use in various installations have gone into this model.

Based upon the principle of "electrostatic precipitation," the Electro-Staynew actually charges the dust particles as they enter the unit. The particles are then attracted to and held by the negatively charged collector plates as shown in the diagram at the right.

By this method, the Electro-Staynew removes dust, smoke, soot, and microscopic particles (as small as 1/250,000 of an inch in diameter) from the air with higher efficiency and lower maintenance cost than is possible with any other type of filter. In addition, this new Electro-Staynew Precipitator has *unit* construction—ionizing and collecting chambers are in *one* compact unit.



ADVANTAGES OF UNIT CONSTRUCTION

- Simplicity of design for trouble-free operation.
- Lighter weight for ease of installation.
- Fewer parts to assemble.
- All high voltage leads from the front.
- Overhead mounting possible.
- Horizontal or vertical air flow.
- Units engineered to each job.

The simple unit construction of the Electro-Staynew gives it unusual flexibility. Combinations of the two basic cell sizes make possible complete installations of any desired capacity. This feature also saves time in assembly and greatly simplifies installation. The lightweight construction permits overhead mounting where necessary, and . . . with unit construction—all high voltage leads may be made from the front for added convenience and safety.

SEND FOR THIS BULLETIN 400 TODAY!

New Bulletin 400 has information of interest to every engineering department. Keep it handy to answer filtration questions on industrial ventilation.

ELECTRO-STAYNEW BULLETIN CONTAINS...

- detailed diagrams on how the Electro-Staynew cleans air.
- description of all component parts.
- cutaway view of suggested installation.
- complete mechanical and electrical specifications.
- examples of fool-proof safety features.
- report of studies that prove Electro-Staynew sets new standards for economy.
- convenient chart of sizes and material list.

DOLLINGER PROTECTED QUALITY STAYNEW FILTERS

DOLLINGER CORPORATION

9 Centre Park Rochester 3, New York

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

The U. S. Steel Supply team that gives you

personalized service

Our "speed specialist" keeps your order on the move!

OUR traffic manager hates to hold your order in our warehouse. As soon as it is an order—for steel, tools, equipment or machinery—he gets it out of our warehouse and into your plant as fast as possible. For local delivery, he dispatches a fleet of specialized trucks and a crew of competent drivers who are proud of their record for quick, dependable service.

If you specify delivery or routing instructions on out-of-town shipments, our traffic manager will see that they are followed exactly. If you leave the routing up to him, he will schedule delivery so as to give you the best possible protection in the matters of both cost and service. He studies the special unloading requirements of each of our customers, and ships accordingly.

When special conditions—speed, convenience or any other—should be observed in the delivery of your order, you can get the *personal* attention of our traffic manager through your U. S. Steel Supply salesman or telephone salesman.

YOUR "ONE CALL" SOURCE OF STEEL SERVICE

U.S. STEEL SUPPLY

UNITED STATES STEEL SUPPLY DIVISION, UNITED STATES STEEL CORPORATION
HEADQUARTERS: 208 So. LA SALLE ST., CHICAGO 4, ILL. WAREHOUSES AND SALES OFFICES:

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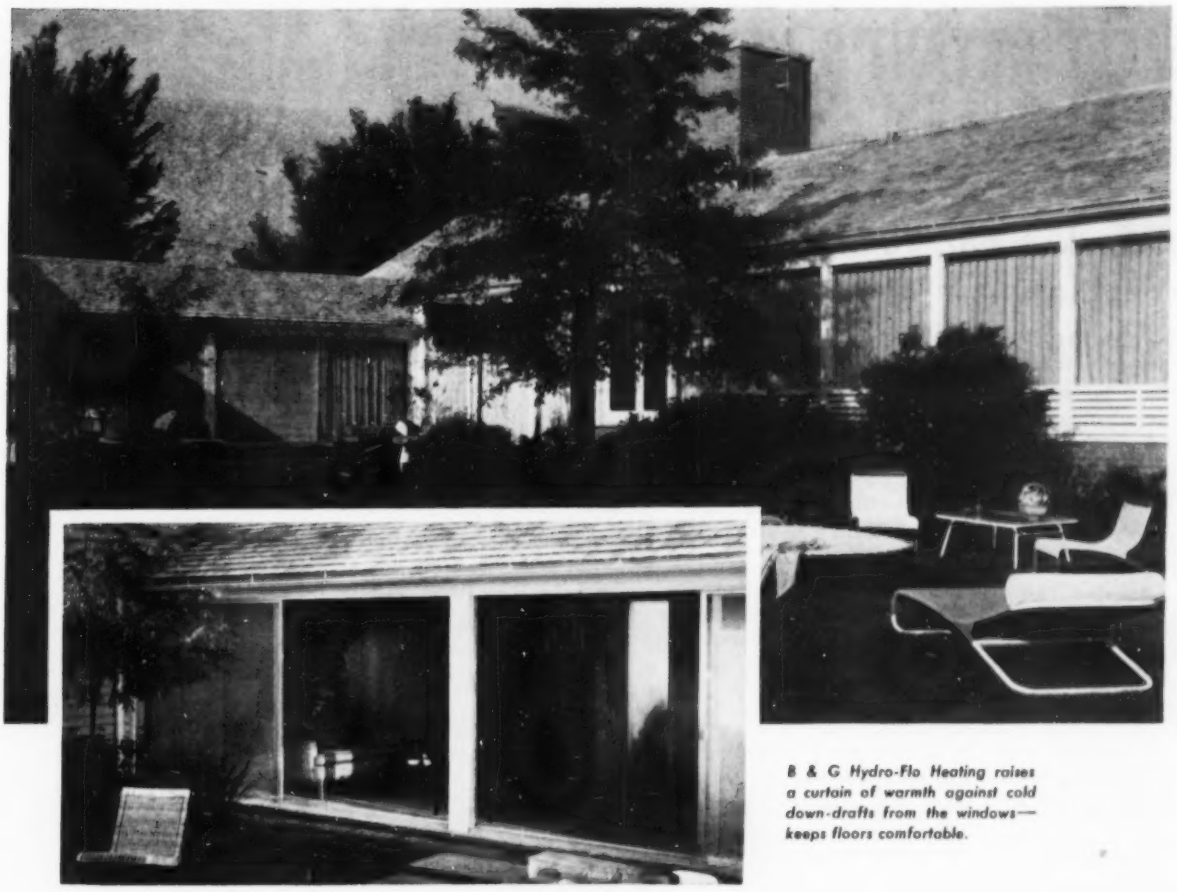
UNITED STATES STEEL



B & G Hydro-Flo Heating raises a curtain of warmth against cold down-drafts from the windows—keeps floors comfortable.

1952 "House of Ideas" selects

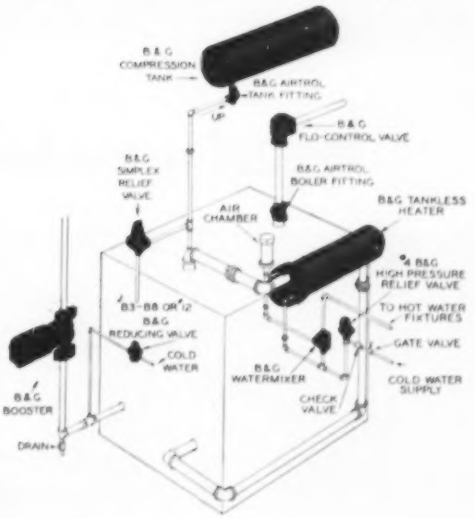
B&G *Hydro-Flo* Heating

Here is a striking example of the way in which B&G *Hydro-Flo* Forced Hot Water Heating solves the problem of heating homes with large glass areas.

In the "House of Ideas," sponsored by House and Garden, a 3-zone B & G *Hydro-Flo* System with radiant floor panels makes every inch livable space. B & G Comfort Controls (outdoor type) assure close control of temperature and provide compensation for wind effect.

This installation is indicative of the sweeping trend to forced hot water heating. Today you'll find B & G *Hydro-Flo* Systems in buildings twenty stories high . . . in garden apartments covering acres . . . in low-cost housing developments. The comforts of radiant warmth, *plus* positive heat control which keeps indoor temperature uniform and prevents fuel waste, are ample reasons for this preference.

B & G *Hydro-Flo* equipment covers every requirement of forced hot water heating systems. Send for catalog.



Typical B & G Hydro-Flo Hot Water Heating installation with tankless domestic water heater.

BELL & GOSSETT
COMPANY
Dept. CV-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada

MEET BRYANT'S NEW "Command-Aire" TWINS

. . . now in mass production to make year 'round home conditioning a mass-market sales opportunity . . . for you!

Home builders and home buyers everywhere are enthusiastic about the new Bryant "Command-Aire" Twins. Here's why:

- They're being mass produced to bring the price of *complete* home comfort within the budget of *average* home buyers . . . *30 to 50% less than heretofore!*
- They're independent heating and cooling units matched in appearance and size. Builders can install the furnace first and offer the addition of air conditioning immediately, or later, according to the convenience of the buyer.
- They're being aggressively promoted on national and local levels—even right on the home site—to presell thousands who will buy homes this year.

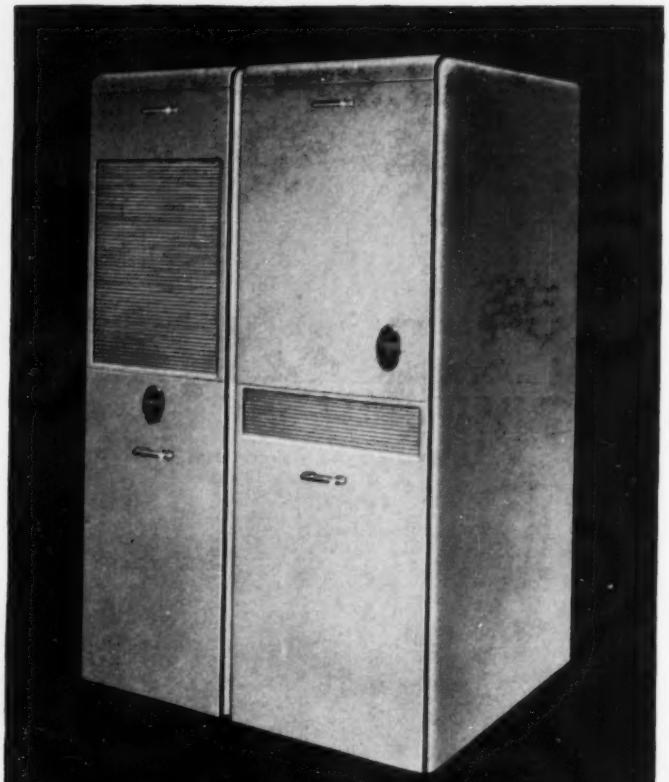
Here is a new, big-volume, high-profit sales opportunity for alert heating and air-conditioning dealers!

Homeowners want year 'round conditioning because it adds extra enjoyment . . . extra resale value.

Bryant's "Command-Aire" Twins now make it possible for them to have it at a price millions can afford.

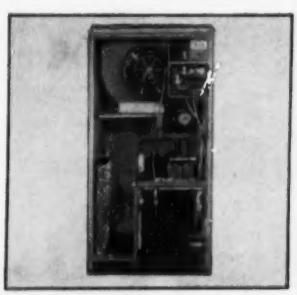
You can be one of the first to profit—by investigating this opportunity today!

Your nearby Bryant Distributor will be happy to provide complete details. Or write direct to Bryant Heater Division, 17825 St. Clair Ave., Cleveland, O.



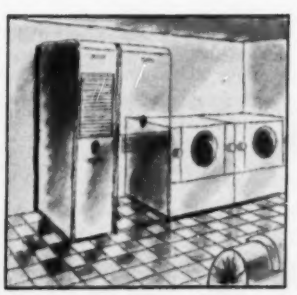
The "Command-Aire" Twins consist of a new Bryant Forced Warm-Air Furnace (*gas* or *oil*) combined with a new self-contained Bryant 2, 3 or 5-ton Air Conditioner. Many combinations of heating and cooling capacities are available.

bryant® means business... better business for dealers



Air Conditioner is independent unit with its own blower, filter and controls . . . eliminates need for air to pass through both units . . . improves both heating and cooling efficiency.

Five-year warranty on the hermetically sealed cooling compressors of the 2 and 3-ton "Command-Aire" cooling units . . . has tremendous appeal to prospective buyers.

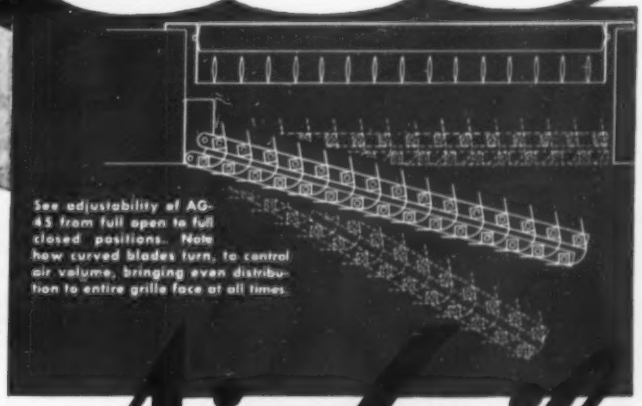


One cooling unit sells hundreds! Builder can install "Twins" in his model home and leave space for the cooling unit in the others—where your prospects will live.

Powerful promotion presells "Twins"! Extensive national advertising and local publicity and promotion will presell the "Twins" to hundreds in your area.

NEW ADJUSTABLE DOUBLE DUTY AIR VOLUME EXTRACTOR & CONTROLLER

FACTORY ASSEMBLY SAVES UP TO 50% OVER SLOW HAND-MADE METHODS



See adjustability of AG-45 from full open to full closed positions. Note how curved blades turn, to control air volume, bringing even distribution to entire grille face at all times.

11 TREMENDOUS ADVANTAGES:

1	FACTORY ASSEMBLED
2	INSTALLS WITH 2 SCREWS
3	Double Duty Extractor & Vol. Controller
4	Replaces Extra Vol. Controller
5	Equalizes Air Distribution & Air Flow
6	Turns Air from Main Duct
7	Reduces Pressure Losses
8	Stops Excess Turbulence
9	Low Cost
10	Rattle Free
11	14 & 20 Gauge Steel

Air Foil
AIR CONDITIONING OUTLETS

Slash unit costs with this amazing new Titus AG-45. Make it easy for yourself to *keep bids low.* Use this *cost saver* to beat competition. Eliminate the extra work of putting in volume controllers. Save time, labor. IMPROVE THE AIR CONTROL EFFICIENCY OF EVERY INSTALLATION. Get complete free information now. Order a sample AG-45 today. Remember, not until you have one of these AG-45s in your hand, can you see its *amazing cost-saving value.* IMMEDIATE DELIVERY.

Free

Check Type of Grille on Which Information is Desired:

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Industrial grilles
- ☐ Special made-to-order grilles.

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ RUSH information on AG-45 Extractor & Controller
- ☐ Send complete catalog
- ☐ Send literature on above checked items

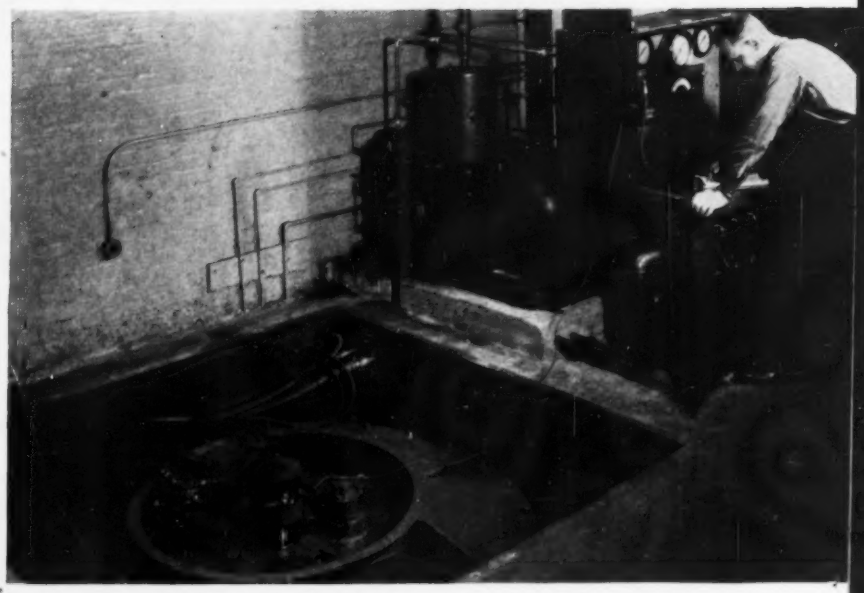
NAME _____

ADDRESS _____

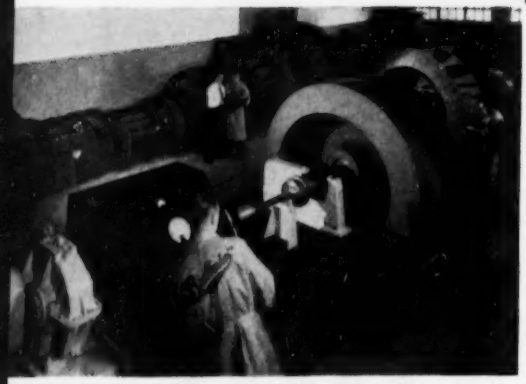
CITY _____ STATE _____

Why it costs more to build

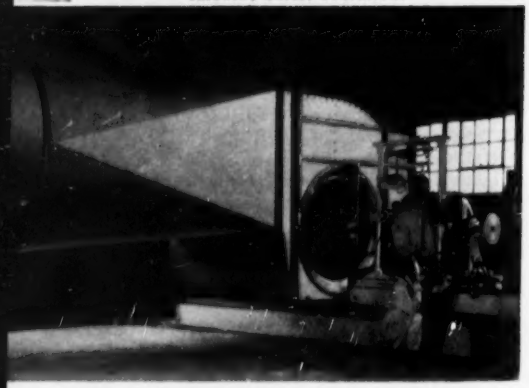
"Buffalo" FANS



Buffalo vacuum pit for test-spinning rotors. Extremely low vacuum in pit enables rotors to be spun at high speeds to ultimate destruction.



Dynamic balance of Buffalo fan wheels guarantees smooth, quiet, operation.



Accurate testing assures rated performance of Buffalo Fans.

As many readers of this advertisement know, "Buffalo" was the first manufacturer of air moving equipment to treat air engineering as a serious scientific subject, worthy of continuous study. With the publication, in 1914, of "Fan Engineering", now in its Fifth Edition, Buffalo Forge Company paved the way for the tremendous expansion in all forms of air handling, conditioning and cleaning, which we now accept as common-place.

We have never deviated, for one year, from the ideals which led to "Fan Engineering" in 1914. We are still interested basically in the "Q" Factor*. This means the building of the best possible product.

This policy has cost us some business in the past, and no doubt will in the future. It has, however, earned us a reputation for fine performance over long periods of years, and has enabled our company to sell many of the finest and most outstanding installations in industry and commerce.

When you buy Buffalo Fans, Air Cleaning or Conditioning Equipment, you can be sure that you are getting the best that seventy-five years of experience can produce.

Engineering Sales Representatives in all principal cities are anxious to work with you.

* — *The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

DIAMOND JUBILEE 75 YEARS ANNIVERSARY

"Buffalo" FIRST FOR FANS

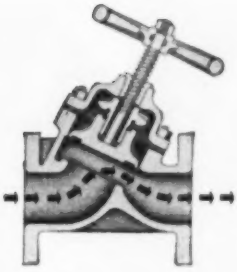
BUFFALO FORGE COMPANY

171 MORTIMER ST. BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING | PRESSURE BLOWING AIR CLEANING | COOLING AIR TEMPERING | HEATING INDUCED DRAFT | FORCED DRAFT EXHAUSTING



FOR SAFER CONTROL ⟶ OF HARD-TO-HANDLE FLUIDS

CRANE Packless Diaphragm Valves

Now Available in New Materials

WORKING PRESSURES—up to 150 pounds. Water, air, oil, or gas, 180°F. maximum temperature, depending on valve size and materials.

You asked for it—and now Crane gives you this outstanding Diaphragm Valve in a new wide choice of body, disc insert, and diaphragm materials—in unlined or lined patterns. Whichever is specified, Crane design gives you important advantages including—long diaphragm life . . . positive shut-off in case of diaphragm failure . . . less resistance to flow with minimum pressure drop . . . easy operation . . . simplified maintenance at lowest upkeep cost.

Full specification data is in your new Crane 53 Catalog—or ask your Crane Representative.

SCREWED ENDS, UNLINED Sizes ½ to 2 in.
Brass, Cast Iron, Aluminum, or 18-8 Mo body and disc. Furnished with neoprene, Buna N, and natural rubber diaphragm and disc insert.

FLANGED ENDS, UNLINED Sizes ½ to 6 in.
Cast Iron, Aluminum, or 18-8 Mo body and disc. Furnished with neoprene, Buna N, and natural rubber diaphragm and disc insert.

FLANGED ENDS, LINED Sizes 1 to 6 in.
Cast Iron body only. Lined with neoprene or hard natural rubber. Disc coated with neoprene or soft natural rubber.

Other body and disc materials, as well as linings, available on special order. Also sliding stem valves for automatic operators of all types.

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

WeldELLS®

...have set their own standards

Many of the largest users of Welding fittings refuse to accept any other fittings than WeldELLS.

They have found that when the name, WeldELL, is stamped into a fitting, that fitting can be accepted without question for any service for which it is designed.

They have found that WeldELLS have features that please both the men who design and the men who erect welded piping . . . features that were pioneered by Taylor Forge . . . features that are combined in no other welding fittings.

They have found the answer to their every need in the greater range of sizes, weights and types of the WeldELL line . . . in the broader scope of materials.

Ask for up-to-the-minute facts about WeldELLS and Taylor Forged Steel Flanges.

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TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.

Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

Announcing!

New DUNHAM HANDBOOKS on Heating!

These two new Dunham Handbooks on Heating are packed full with valuable "how-to" information. They cover selection, application and installation features of Radiation, Unit Heaters, Vacuum and Condensate Pumps, Heating Specialties and complete Heating Systems.

Dunham 400-page Handbook on Heating is an attractively bound desk reference book designed to solve many of your wet heating system problems. It is especially valuable for architects, heating engineers and for use as a basic school text book.

Dunham 272-page Pocket Manual on Heating furnishes clear, concise answers to many questions on wet heating systems that occur on the job. And this saves you time and money! Pocket Manual is adapted from the 400-page Handbook with emphasis on application and installation information of greatest value to contractors and maintenance men.

Mail coupon *today* to take full advantage of special introductory offer!

With this coupon, you can get the Dunham Handbook for only $2.50 (Regular price $5.00). With coupon, the Dunham Pocket Manual is only $1.00 (Regular price $2.50).

DUNHAM

HEATING SYSTEMS AND EQUIPMENT

C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON

C. A. DUNHAM COMPANY
Dept. 2
400 W. Madison St., Chicago 6, Ill.

☐ Enclosed find $2.50 for Dunham Handbook
☐ Enclosed find $1.00 for Dunham Pocket Manual

Name_____

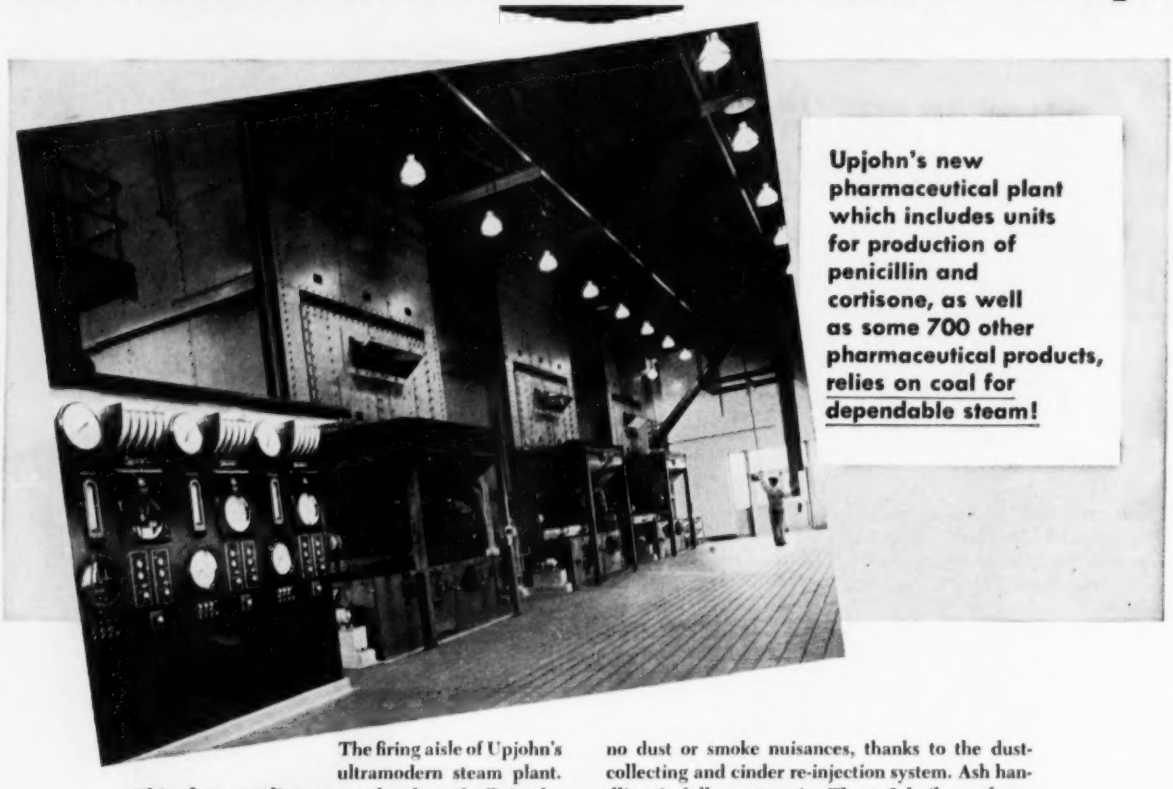
Firm name_____

Address_____

City_____ Zone____ State_____

For LOW-COST DEPENDABLE steam,

UPJOHN burns COAL the modern way!



Upjohn's new pharmaceutical plant which includes units for production of penicillin and cortisone, as well as some 700 other pharmaceutical products, relies on coal for dependable steam!

The firing aisle of Upjohn's ultramodern steam plant. This plant supplies steam, cleanly and efficiently, at only 40¢ to 42¢ per 1,000 lbs. for the Portage Road Plant near Kalamazoo, Michigan. There are no dust or smoke nuisances, thanks to the dust-collecting and cinder re-injection system. Ash handling is fully automatic. These 3 boilers, plus a fourth recently installed (not illustrated), deliver up to 115,000 lbs. steam per hour at peak load.

Whether you're building a new plant or modernizing an older one, you can count on coal for dependability and low-cost operation.

Here's why: Up-to-date coal-burning equipment can give you 10% to 40% more steam per dollar. Automatic coal- and ash-handling systems can cut your labor cost to a minimum. Let a consulting engineer show you how a modern coal installation, tailored for your specific needs, can save you real money.

Here's something else, too—of all fuels, coal alone has virtually inexhaustible resources. This, plus the fact that America's highly mechanized coal industry is the most efficient in the world, assures you of a dependable supply of coal at relatively stable prices now and for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

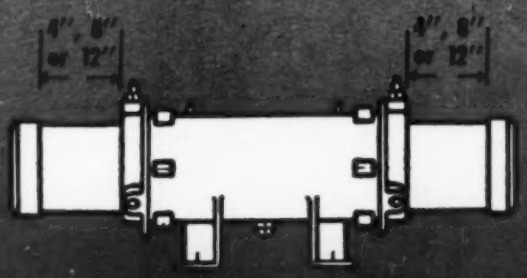
BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

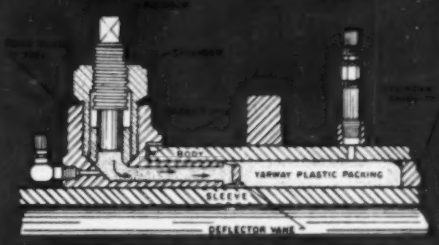
YOU NEED FEWER JOINTS



With Yarway Gun-Pakt slip-type expansion joints you need fewer joints than with other types, because each sliding sleeve has a traverse of 4", 8" or 12" . . . maximum expansion being 24" for a double-end joint.

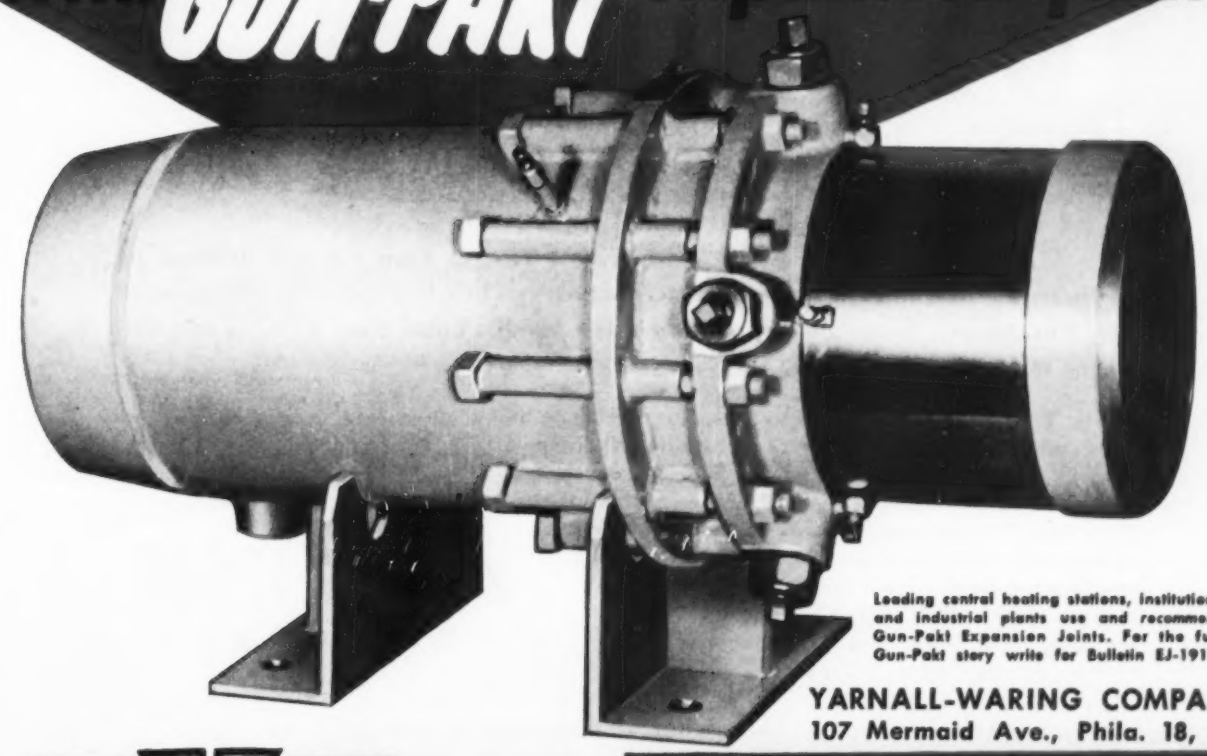
For example, one single-end Yarway Gun-Pakt joint with an 8" traverse is all that is needed for a 200 ft. run of steel pipe carrying saturated steam at 350 psi.

AND LESS MAINTENANCE



No need for shutdowns. Yarway Gun-Pakt Joints are serviced under full steam pressure. Just insert a plug of Yarway plastic packing, twist a wrench and the job is done. Maintenance and production manhours are saved!

with GUN-PAKT expansion joints

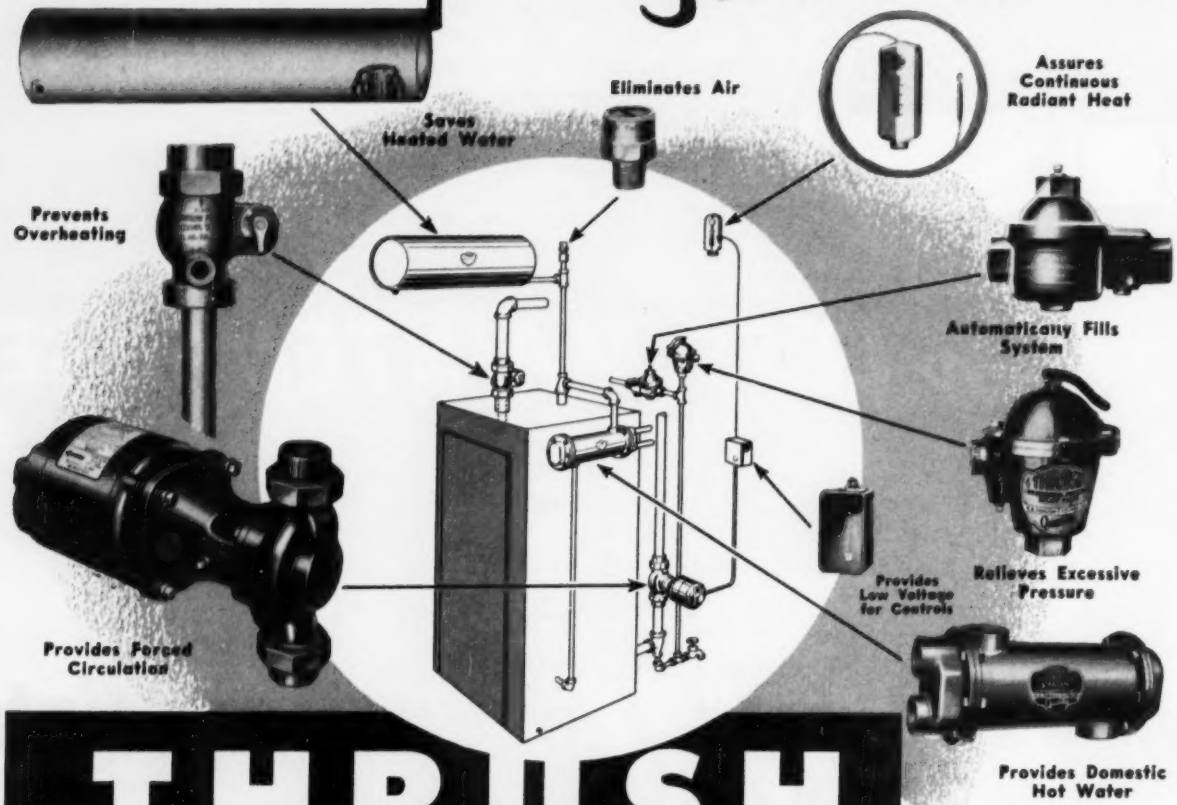


Leading central heating stations, institutions and industrial plants use and recommend Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

Sell Completely Automatic



THRUSH
flow control HOT WATER HEATING

SUCCESSFUL DEALERS, who install Thrush Flow Control Systems on all their hot water heating jobs, tell us that every Thrush installation sells another one. Enthusiastic home owners tell their friends . . . build good will . . . and that means more sales and profit for you.

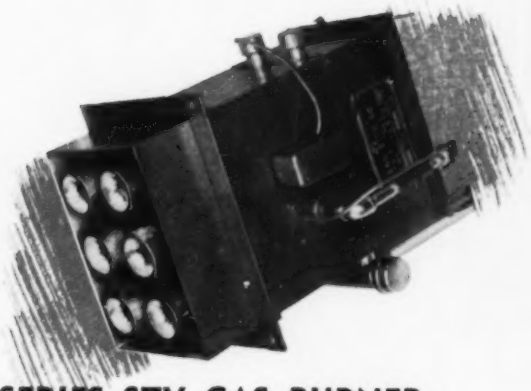
Thrush Flow Control System has everything to make sales easier and satisfy customers . . . unlimited choice of heating units (baseboards, radiant panels, convectors, etc.,) . . . fuel economy . . . small piping . . . comfort (less than 1° room temperature variation) . . . plenty of domestic water from the one boiler and years of trouble-free service. Sell the best heating equipment — SELL THRUSH. See your wholesaler for free Sales Helps and Free Engineering Service or write Dept. E-2 today!

H. A. THRUSH & COMPANY
PERU, INDIANA

Assures a Continuous Flow of Radiant Heat

JOHN ZINK

JZ BURNERS *for All* HEATING *and* POWER NEEDS

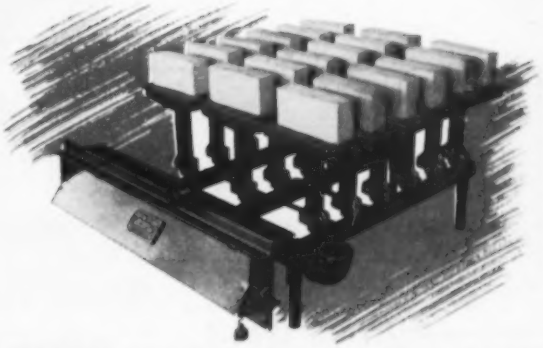


SERIES STV GAS BURNER

4" to 2#

Ideal for heating boiler installations. From one head to fifty heads. Quiet, efficient and economical operation.

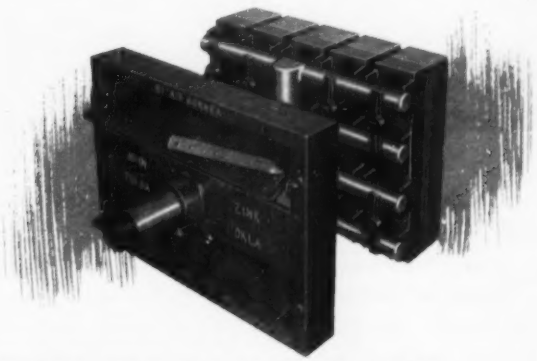
Write for literature.



SERIES VR VERTICAL GAS BURNER

4" to 4 oz.

This burner is one of the "upshots" or vertical radiant type with multiple burner heads so designed as to entrain a certain amount of primary air from the total air entering through the louvre. The "VR" burners are especially designed to operate in boilers having low draft and small combustion space.



SERIES "R" BI-AIR BURNER

4" to 1#

For all types and sizes HEATING BOILERS and small Power Boilers — JOHN ZINK offers the Series "R" Bi-Air short flame, Gas Burner with Multi-Jet burners, having refractory semi-venturi mixing throats, with a separate gas orifice to each throat. Capacities to meet your requirements.
Especially adapted for installing in boilers having very low draft and small combustion space.

SUSPENDED UNIT HEATER

The John Zink UHS Gas-fired fan type suspended heater is a complete, packaged unit and fully automatic. A. G. A. approved for natural, mixed, manufactured or LP Gas.

New JZ Units for '53

Dual Cooling and Heating Unit for all weather conditioning.

•

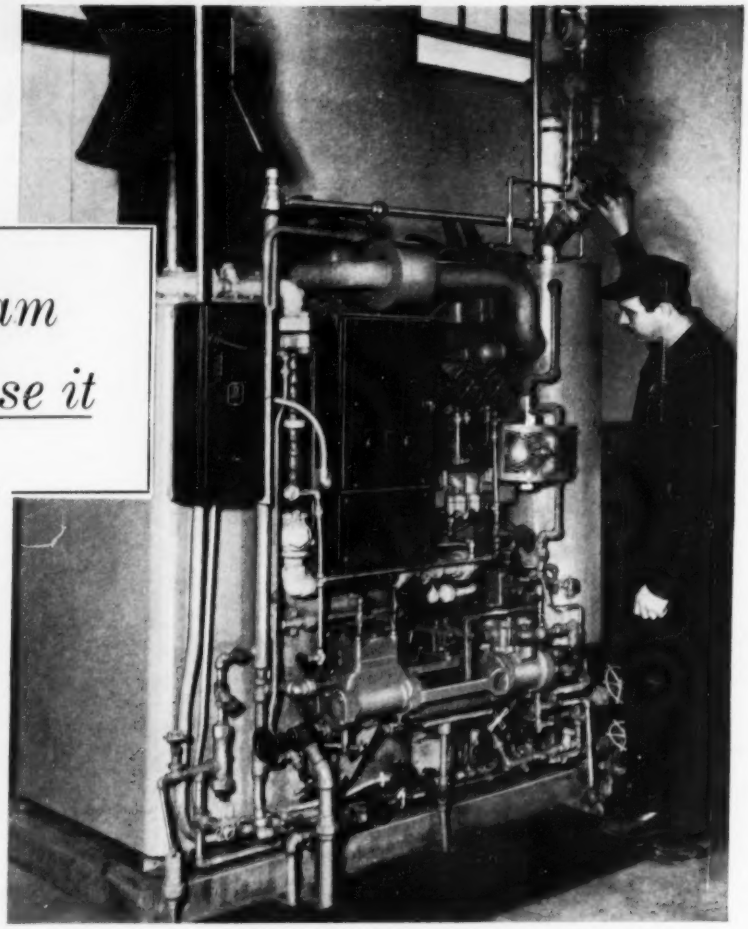
New Single Cabinet

Central Heater with provision for later installation of cooling unit.

WRITE FOR LITERATURE

JOHN ZINK COMPANY
4401 South Peoria Tulsa 5, Oklahoma

Make your steam
where you use it
with this . . .



PUSH-BUTTON STEAM PLANT

Just push the button — and in a matter of minutes the C-E Re-circulation Steam Generator will give you up to 6,000 pounds of steam per hour at up to 300 psi. That's just about all there is to it.

For the C-E Re-circulation Steam Generator is more than a package boiler — it is a fully integrated, fully automatic, steam plant complete with all controls and accessories, and it takes a minimum floor space . . . about the same as two office desks.

If you have a space 7 feet square by 8 feet high and you need steam for . . .

. . . remote spots not served by present steam lines, or involving long, wasteful pipe lines

. . . occasional loads that exceed the capacity of your present steam generating equipment

. . . highly fluctuating loads and those involving sudden heavy demands

. . . any conditions requiring maximum output from minimum space, with minimum attention.

If you do — or wherever you need a compact . . . reliable . . . automatic source of steam for heat or process — don't just buy a boiler — investigate the C-E Re-circulation Steam Generator. You'll find further details in bulletin p-323a. May we send you a copy?

IF COAL IS YOUR FUEL . . .

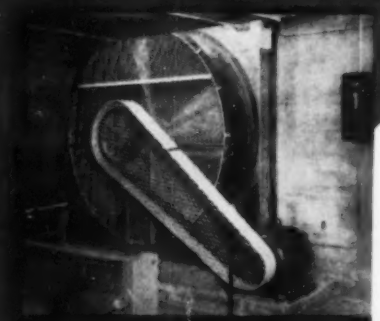
. . . investigate the C-E Skelly Stoker for best results with either bituminous or anthracite.

COMBUSTION ENGINEERING — SUPERHEATER, INC.

200 Madison Avenue • New York 16, N. Y.

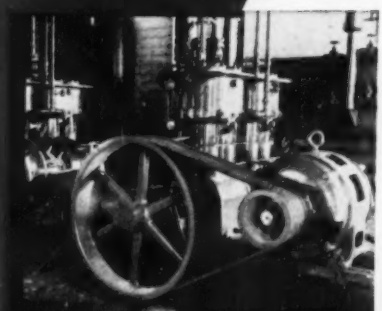
B-581

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



Century motor driving a large fan.

WHY Century MOTORIZED EQUIPMENT KEEPS YOUR CUSTOMERS *SATISFIED...*



Two 100 horsepower Century motors driving refrigeration compressors.

The motor specifications—where skillfully selected—to assure the TOP PERFORMANCE and DEPENDABLE QUIET SERVICE that is built into each class of equipment.

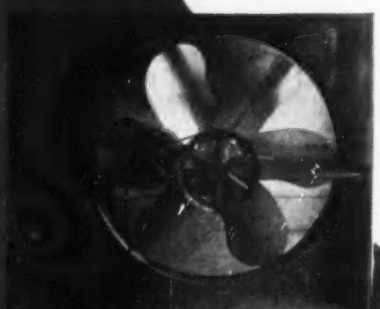
Refrigeration compressors require one combination of operating characteristics and specifications—fans and blowers another combination—various types of heating equipment still another.

In over 50 years, Century has developed a wide line of types of motors with literally hundreds of specifications to choose from. It is easy to ENGINEER YOUR PRODUCT PERFORMANCE—THROUGH SKILLFUL MOTOR APPLICATION.

Century ½ horsepower capacitor motor on a furnace blower.

If you have motor service problems, phone or write to any of Century's 28 District offices regarding Century's national network of service stations—the motor exchange plan will serve you whether your motors are in or out of warranty.

Specify Century Motorized Equipment—get top equipment performance—dependable quiet service—keep your customers satisfied.



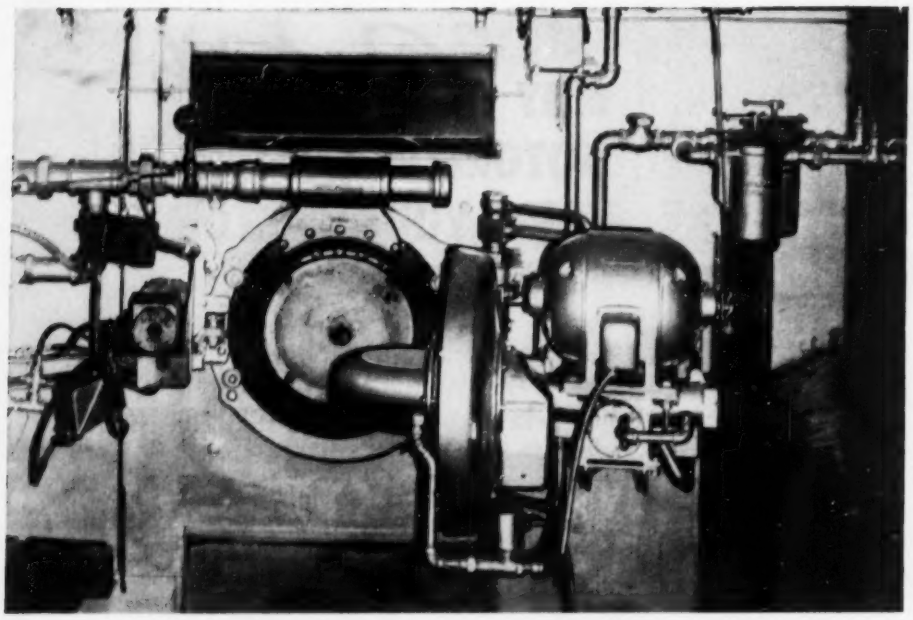
1/6 horsepower Century motor on a ventilating fan.

CENTURY ELECTRIC COMPANY
1806 Pine Street • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Century C MOTORS

Change fuels at a moment's notice



MR. JOHN H. MILLER, *General Manager*, New Method Laundry, Columbus, Ohio.

"Iron Fireman gas-oil firing is profitable investment"

"Four years ago we installed Iron Fireman gas-oil firing in our 200 horsepower water tube boiler. During peak periods our load often exceeds 150% of rating. Heavy steam demands are required without warning. Iron Fireman gas-oil firing has met the test. The changeover from gas to oil and back again can be made in a few minutes, without interruption. Our steam costs are low, and maintenance is negligible."

At left, Iron Fireman Ring Type gas burner in operation in the New Method Laundry boiler room. Iron Fireman Rotary heavy oil burner is swung back out of firing position.

Iron Fireman

Dual or Triple Fuel Firing

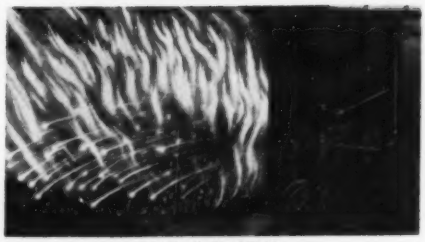
Use GAS, OIL and COAL interchangeably

With Iron Fireman firing you can burn any fuel you wish interchangeably—gas-oil, gas-coal, oil-coal, or all three. In woodworking plants any or all of these fuels are successfully combined with a fourth—wood waste.

High combustion efficiencies are obtainable with oil, gas or coal. As price advantage shifts from one fuel to another your steam plant can shift with it—for the long pull if necessary. Or you can change fuels every day when desirable. This is routine practice in plants where the gas supply is reduced during daily peak periods.

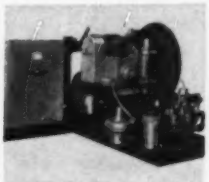
Avoid costly shut-downs

Fuel emergencies, due to interrupted or short supply, can be disastrous. Yet protection against such emergencies may cost you little or nothing when offset by the fuel and labor savings of Iron Fireman multiple fuel firing.



GAS, OIL, COAL

Equipment includes Ring Type gas burner, Rotary oil burner, and Pneumatic Spreader stoker. Coal is automatically dried, pre-heated and conveyed from bunker to boiler. No manual handling; no costly conveying equipment.



GAS-OIL PACKAGE UNIT

For Scotch marine and other types of boilers. Has integral forced draft and control panel wired and tested at factory.

GAS-OIL BURNER

Ring Type Gas Burner and Rotary Oil Burner on single mounting. Fuels can be shifted instantly.

Send for full information

IRON FIREMAN MANUFACTURING CO.
3065 W. 106th Street, Cleveland 11, Ohio.

Please send literature on Iron Fireman multiple fuel firing.

Name _____

Address _____

City _____ State _____

AUTOMATIC FIRING FOR HOMES, BUILDINGS, INDUSTRIAL PLANTS

To meet your needs . . .

W-S FITTINGS OF FORGED

STAINLESS STEEL

Standard Design

The "Featherlite"

Stainless systems are critical and costly...Protect them where trouble usually starts . . . with

W-S FORGED STAINLESS FITTINGS

These life-of-the-system joints are available in either screw-end or socket-welding types to meet your *assembly* needs. They're manufactured for stock in the more popular grades to meet your *process* needs. And they're all precision machined from solid STAINLESS Steel Forgings to meet a *universal* need for the strongest, most accurate and trouble-free fittings money can buy.

Get the full benefit of your investment . . . insist on W-S FORGED fittings wherever costly stainless pipe or tubing meet . . . *permanently*.

WRITE FOR BULLETIN S-1 for Standard Design 2,000 to 6,000 pound cold non-shock pressure

WRITE FOR BULLETIN S-2 for "Featherlite" Design 1,000 pound cold non-shock pressure

Screw-End and Socket-Weld Types

• **Tighter** • **Stronger** • **More Uniform** • **Lower Service Cost**

SOLD THROUGH LEADING DISTRIBUTORS . . . EVERYWHERE

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

ROSELLE, NEW JERSEY

9-53-69

Designers and Manufacturers of Forged Steel Fittings, Hand Pumps, Jacks, Wire Rope Shears and Pipe Benders

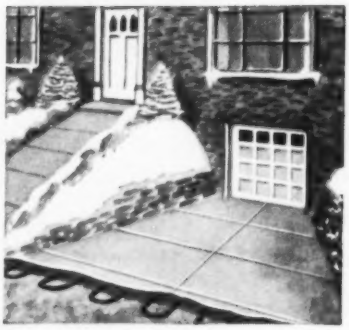
"What a shame!... they don't have snow melting"

As she looks at her neighbor's plight, the woman next door can thank her lucky stars that *she* insisted on driveway snow melting. She knew the dependence of modern suburban dwellers on the family car . . . for transportation to and from work, for shopping, visiting, church going, and for emergencies!

Suburban living can be wonderful in fine weather, but when snow or ice hits, a car can be tied up tight in the owner's driveway or garage approach, even though the streets and roads have been cleared.

So, more and more, home owners are installing driveway and sidewalk snow melting systems. They consider it a sound investment, for in addition to assuring mobility at all times, it eliminates snow removal expense, spares the human back, and adds appreciably to property value.

You can be sure when you specify steel pipe, that it is the *first choice* for such installations. Its known economy, proved durability in over 60 years of hot water and steam heating applications, formability and weldability for coils and grids, make it a natural selection. In fact, for snow melting, radiant heating, conventional heating and other uses, steel is the most widely used pipe in the world!



With a driveway snow melting system the family car is always instantly available for pleasure, business, or emergency use. Steel pipe snow melting keeps Americans mobile!

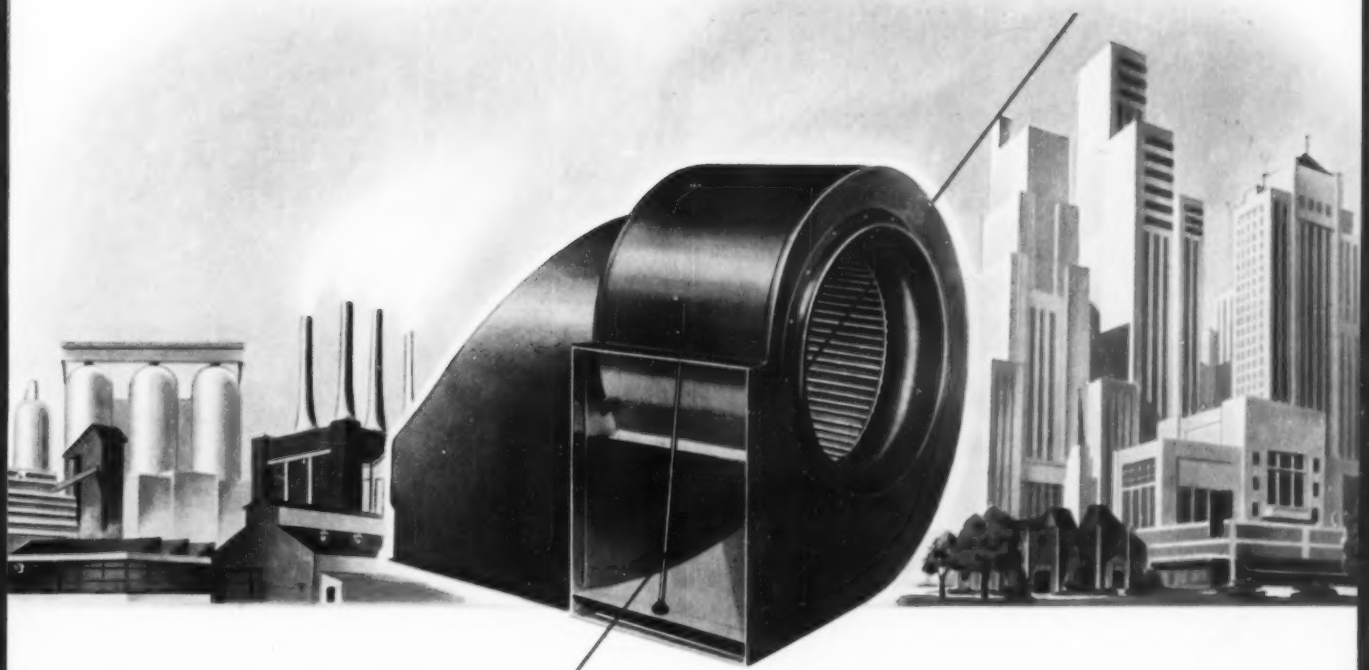
Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N.Y.

American Blower – a time-honored name in air handling



The heart of an American Blower Utility Set is this dynamically balanced Sirocco wheel which provides large volumetric capacities at low peripheral speeds.

Need air in your business?

Want a "work horse" that has proved to be a good investment in hundreds of industries?

Then, put these time-proved, quality-built American Blower Utility Sets to work. They are unsurpassed for general ventilation where duct systems are required.

There's an American Blower product for every air handling need — for process work, for pressure duties, for ventilating, heating, cooling, air conditioning.

Just call one of our branch offices for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER

We can learn from bankrupt Micawber

"MY advice, Copperfield, you know. Annual income twenty pounds, annual expenditure nineteen-nineteen-six, result happiness. Annual income twenty pounds, annual expenditure twenty-ought-six, result misery. The blossom is blighted, the leaf is withered—in short you are forever floored. As I am!"

This is probably the most famous financial counsel in all English literature, offered a hundred years ago by Charles Dickens' character the bankrupt Micawber to the hero David Copperfield. As advice it is just as good in 1953 as it was in 1849, and just as sound for a nation as for an individual.

In 17 of the last 20 years, Uncle Sam has followed Micawber's practice, not his advice. Our national balance sheet has been, figuratively, "annual income twenty pounds, annual expenditure twenty-ought-six". Ahead of us as a nation, if we continue this irresponsible policy, is Micawber's dire predicament, "blossom blighted, leaf withered—forever floored".

There is no sane reason why the world's richest nation should continue to live the financial life of a profligate bankrupt. It is time now to set our house in order. The program called for is simple: (1) Eliminate waste and extravagance in government spending; (2) Balance the Federal budget; (3) Control the national debt and reduce taxes.

By such positive action we can protect future happiness—and prevent misery—for ourselves, our children and our children's children.

QUALITY
YOUNGSTOWN
SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

At left center is one end of fuel oil pipe line (approximately 1,000 ft. long), operating at about 100° F with FOAMGLAS pipe insulation. In foreground is part of 1,100 ft. steam line operating at about 400° F with FOAMGLAS pipe insulation. Note spray pond in background. *Insulation contractor: Thermal Products Company, Houston.*

ON THESE OIL AND STEAM LINES

FOAMGLAS

insulation spends most of its time under a shower but STAYS DRY

Keeping dry under a shower is a slick trick, but magic FOAMGLAS is the one insulation that can do it, day in and day out. That's one big reason why Dallas Power & Light Company chose FOAMGLAS to insulate oil and steam lines running right next to a spray pond handling concentrated alkaline water.

Chief Engineer R. D. Elliott points out, "The combination of water and chemicals really requires an extraordinary insulation, and we've found that neither moisture nor chemicals can penetrate the closed, inorganic cell structure of FOAMGLAS. That's why we count on it to combat corrosion and to maintain constant insulation efficiency."

PITTSBURGH CORNING CORPORATION
PITTSBURGH 22, PA.

R. D. Elliott

Pittsburgh Corning Corporation, Dept. R-23
Pittsburgh 22, Pa.

Please send me free sample and booklets on use of FOAMGLAS for:

☐ Piping and process equipment ☐ Refrigerated Structures
☐ Normal Temperature Buildings
☐ Advise nearest source of supply
☐ Send engineer to discuss specific problem

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

Famous Labels suggest the choice

Many of the big textile mills . . . names your wife will recognize . . . "air-control" many of their manufacturing operations with Worthington air conditioning and refrigeration.

And many of the famous shops where the mills' products are sold . . . Saks Fifth Avenue, The Higbee Company, J. L. Brandeis, Lane Bryant, many Sears Roebuck Stores . . . are air-conditioned by Worthington.

No other manufacturer makes so complete a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Call your local Worthington distributor today. Worthington Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.

America's Leaders... in Many Businesses... Select

WORTHINGTON

A.2.9

AIR CONDITIONING AND REFRIGERATION

The Most Complete Line... Always the Correct Recommendation

NEW
Anemostat
Selection
Manual 45
features for
the first time . . .

duct take-off design data

For the first time data is available to Architects, Engineers and Contractors on static pressure factors for Duct Take-Off Designs. Send for your copy today and save engineering hours and avoid design changes.

ANEMOSTAT®

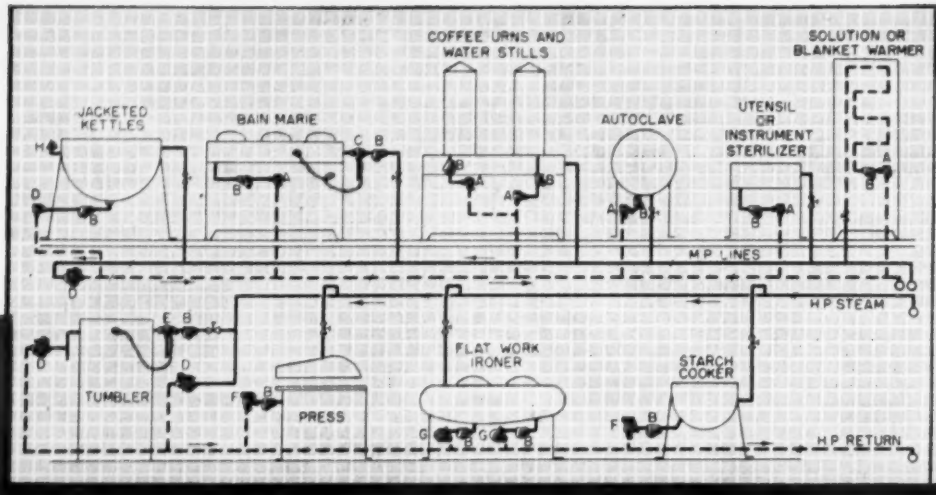
DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

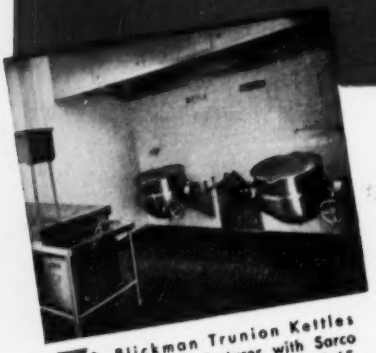
10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"



BUILDING SERVICE EQUIPMENT



S. Blickman Trunion Kettles equipped by manufacturer with Sarco thermostatic steam traps, type S-65, DuPont Hotel, Wilmington, Delaware.

Sarco Thermostatic Steam Traps, type S-65, on S. Blickman Vegetable Steamers at Prudential Insurance Co., Newark, N. J.

Sarco Inverted Bucket Steam Traps on large size jacketed kettles by Legion Utensil Co.

● BUILDING SERVICE EQUIPMENT is just one example of the many steam trapping problems encountered under one roof.

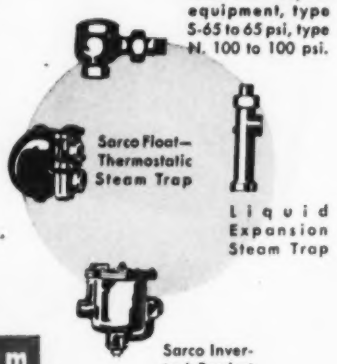
Sarco's four distinct types of steam traps make it possible to select the proper type for each application and yet all of the same manufacture.

That is why Heating Engineers and Piping Contractors prefer Sarco.

Undivided responsibility assures over-all satisfaction to the ultimate user — the objective of both the Engineer and Contractor.

Equipment manufacturers standardizing on Sarco Steam Traps and Controls do so with complete confidence, knowing Sarco will insure proper performance of their equipment.

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y. • Sarco Canada Ltd., Toronto 8, Ontario.



Sarco Thermostatic Steam Trap for kitchen and hospital equipment, type S-65 to 65 psi, type N. 100 to 100 psi.

Sarco Inverted Bucket Steam Trap.

SARCO saves steam

sarco quality assures satisfaction

422

For *Steam* Heating, too, it's **Sarcotherm**!

Effective control of steam heating systems for single or multiple buildings is best accomplished by continuously modulated flow of steam, proportioned automatically by outdoor temperature.

The carefully engineered SARCOSTAT SYSTEM shown diagramatically in Fig. 1 fulfills these requirements perfectly. Many are now in successful operation.

The heart of the system is the Sarcostat hydraulic-electric control valve (Fig. 1) installed in the main steam supply line to each zone and positioned by the combined effect of the outdoor temperature and the influence of steam pressure existing on the downstream side of the valve.

Successful operation is predicated on careful sizing of orifice plates in each radiator or convector, which is part of the engineering service provided by Sarcotherm.

If you are seeking trouble-free heating control of steam systems of any size or type, we shall be glad to place our experience at your disposal without obligation.

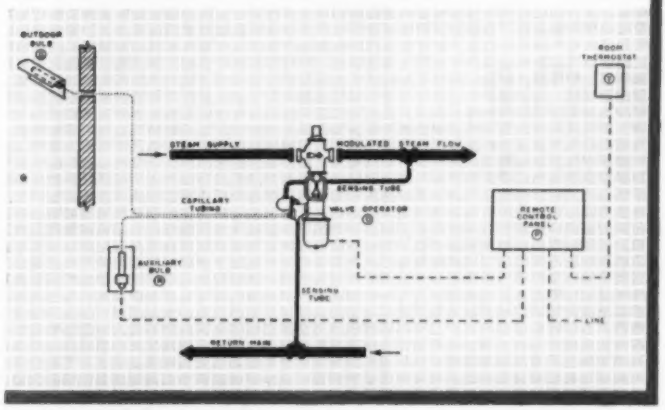


Fig. 1, Typical Hook-up of Sarcostat System.

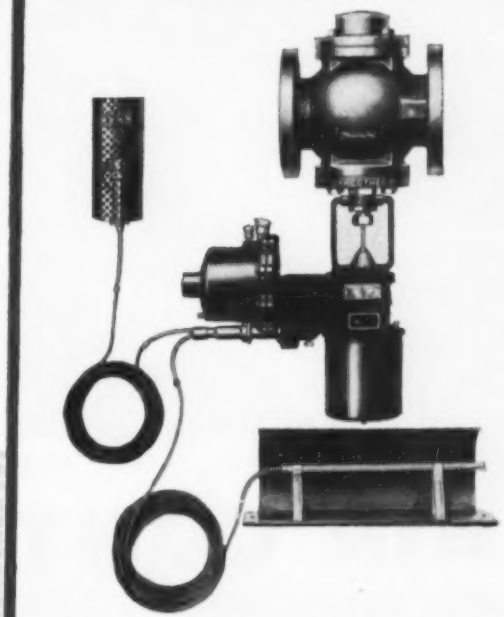


Fig. 2, Sarcostat Modulating Control Valve, Type W-1.

Fig. 3, Type W Manual remote Control Panel is equipped with temperature adjusting knob for "warmer" and "cooler," also a four-position Selector Switch for "Automatic," "Full Heat," "Heat Off," and "Summer."

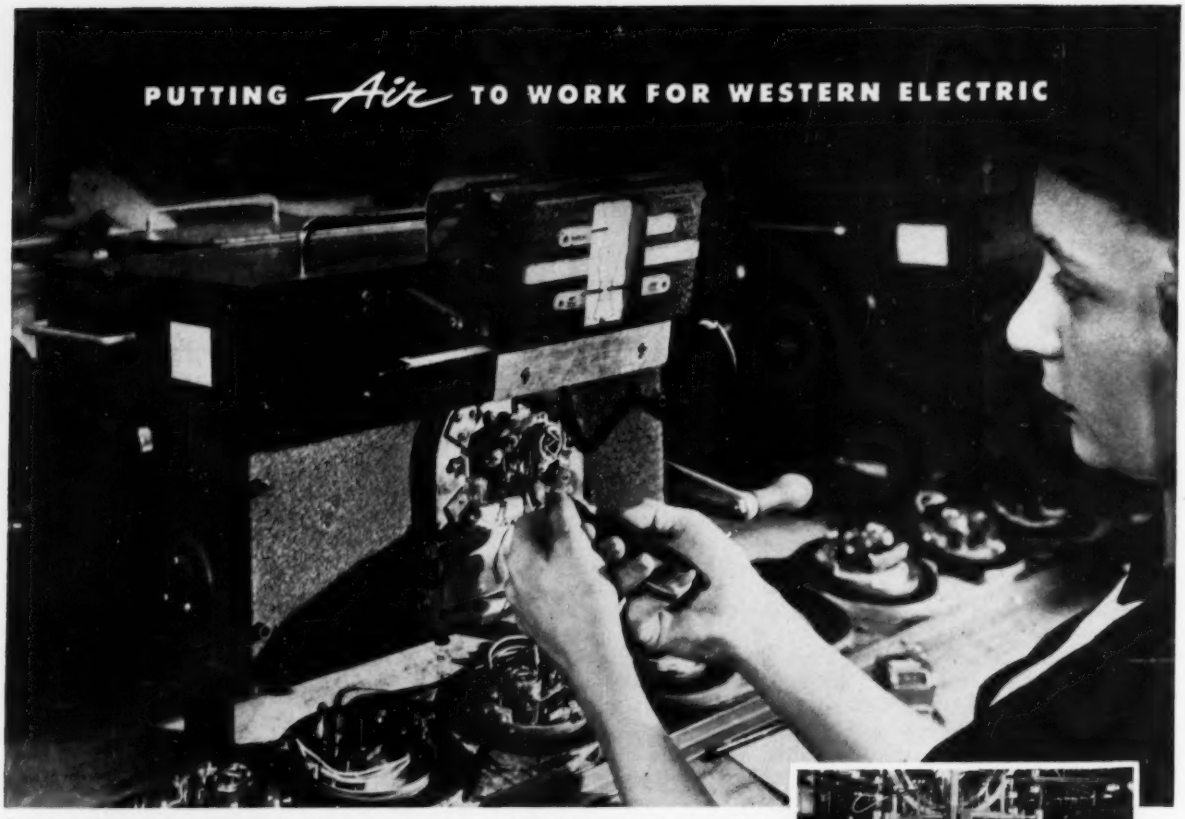
Fig. 4, Type WSA Remote Program Control Panel, adds to the features of type W a time clock to provide automatic morning pickup and night setback, and other features as specified.

Write for NEW Catalog ST500-2

25

SARCOTHERM CONTROLS, INC.

A SARCO PRODUCT



She's adjusting a telephone dial mechanism, surrounded by an invisible dirt barrier of controlled air.

AIR CONTROL

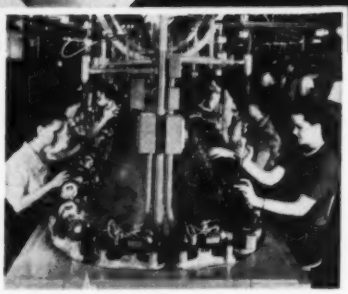
PUTS PRECISION IN YOUR TELEPHONE

If you make a precision product, and mass-produce it, you can't tolerate airborne dirt. That's why Western Electric takes special pains to banish dirt and grit when they make your telephone sets. And they do it in a very simple way. They use *air*.

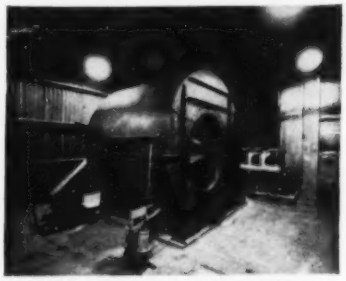
Throughout their huge Indianapolis plant a positive air pressure is maintained—just slightly higher than normal outside atmosphere. This sets up an outward air movement which specks of dirt just can't buck. Result: air keeps dirt out, instead of carrying it in!

32 big Westinghouse fans furnish a constant supply of filtered air 24 hours a day, every day. Because of their high efficiency, they operate at a low power cost. That's important, for at peak capacity these fans move 2,300,000 cubic feet of air per minute.

You can *put air to work* in many ways to improve your own operations. Our trained engineers are ready to help you. And Westinghouse makes the most complete line of air handling, air conditioning and air cleaning equipment. Ask for General Catalog 600 which describes these products and their many uses. Contact your local Westinghouse-Sturtevant office, or write Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.



No dirt means greater precision, fewer rejects, healthier conditions, when controlled air teams up with mass production.



32 efficient Westinghouse fans provide ventilation and keep dirt out. Because of their non-overloading blade design, motor burnouts are not a problem.

YOU CAN BE SURE... IF IT'S Westinghouse

J-80272

AIR HANDLING

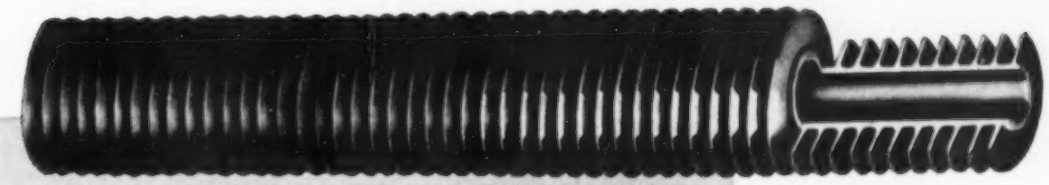
LOOK!

THE FINS OF WOLVERINE TRUFIN* HAVE BEEN SQUEEZED

right out of the tube wall

They are the tube itself—the fins and the tube are integral.

Thus they can withstand vibration and sudden temperature changes—assuring full efficiency at all times.



Trufin is available in (1) a variety of alloys, (2) in fin spacings 5, 7, 9, 11, 16 and 19 fins to an inch and (3) in a range of inside diameters from 5/16" to 1".

Also available in bi-metal with an integral fin construction and different metal lining.

Ask for our new Catalog 201 that will give you more detailed information. If you have an immediate problem dealing with heat exchangers we invite you to call our Customer Engineering Service which can offer much helpful information.

*REG. U. S. PAT. OFF.

WOLVERINE TUBE DIVISION

of Calumet & Hecla, Inc.

Manufacturers of tubing exclusively

1419 Central Ave. **Detroit 9, Mich.**

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

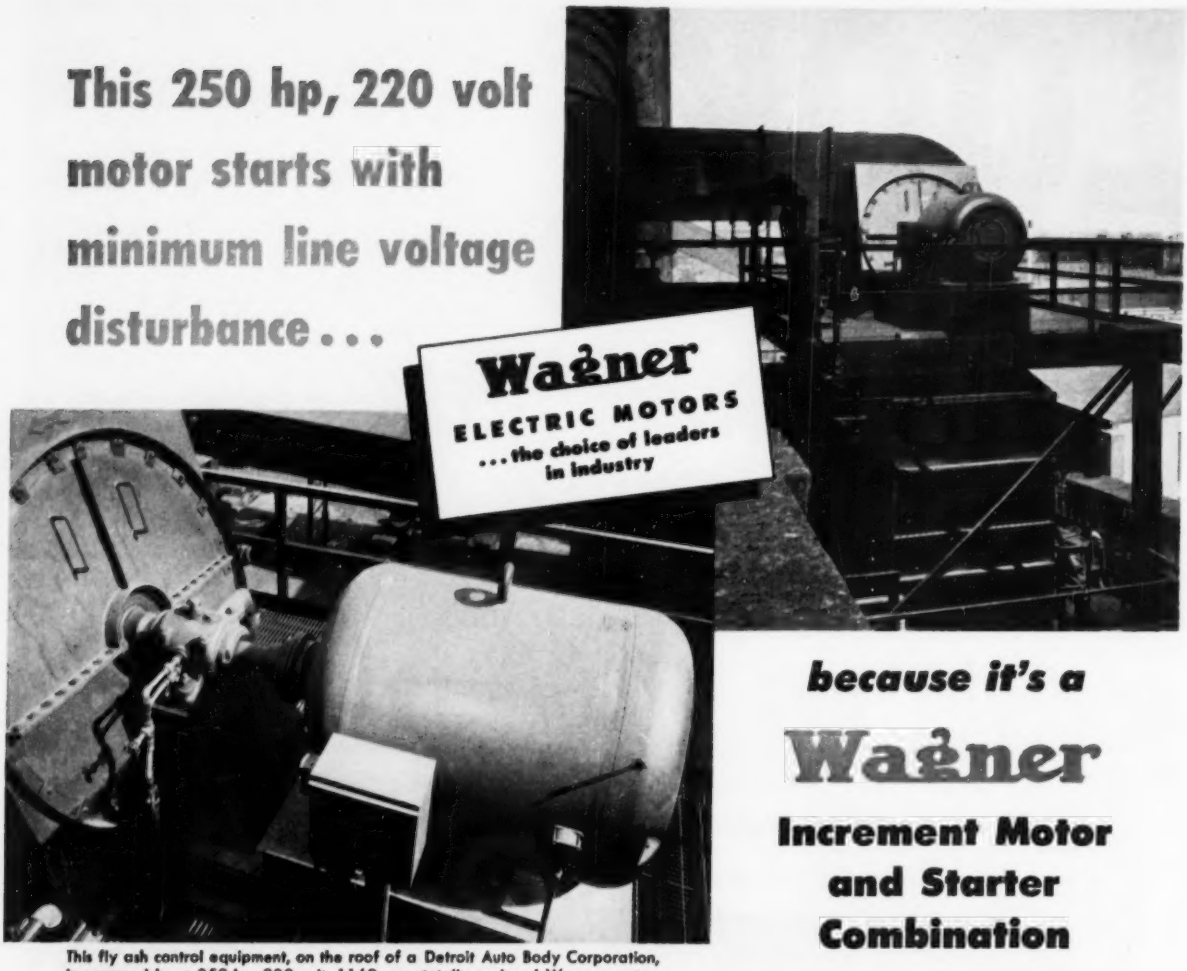
Sales offices in Principal Cities

Wolverine Mill Depots:

DETROIT, MICH. • DECATUR, ALA. • HOUSTON, TEXAS • LOS ANGELES, CALIF.
LONG ISLAND CITY, N. Y. • PHILADELPHIA, PA. • PROVIDENCE, R. I. • ST. LOUIS, MO.

Export Department, 13 E. 40th St., New York 16, N.Y.

This 250 hp, 220 volt motor starts with minimum line voltage disturbance . . .



This fly ash control equipment, on the roof of a Detroit Auto Body Corporation, is powered by a 250 hp, 220 volt, 1160 rpm, totally-enclosed Wagner motor.

because it's a

Wagner

Increment Motor and Starter Combination

The part-winding increment motor and starter combination (pioneered by Wagner) provides an economical method of starting polyphase squirrel-cage motors for any application where reduced current draw at start is required or desirable. No auto-transformers or resistors are necessary.

Voltage disturbances on the line are reduced because current taken from the line is not broken during the starting period—as is the case when auto-transformers or compensator-type starters are used.

You benefit when you install a Wagner increment motor and starter "package" because you get a highly efficient, most economical, motor and starter combination that limits inrush of motor current to values that are acceptable to most power companies for all or parts of their distribution systems.

* * *

When you standardize on Wagner Motors—you get the advantages of a liberal warranty . . . of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 750 Authorized Service Stations. You can choose from a wide variety of types and sizes (from 1/125 to 400 hp.) Bulletin MU-185 gives complete information—write for your copy. Bulletin MU-128 gives full information on Wagner Increment Motor and Starter Combinations.

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

® Wagner Electric Corporation EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M53-6

12 YOUR DISTRIBUTOR

saves your *purchasing time!*

WHEN YOU CONSOLIDATE your orders with your TUBE TURNS' *Distributor,* you delegate to him the job of dealing with many manufacturers' salesmen, of expediting orders, of simplifying your bookkeeping and inventory. He gives you leading nationally-advertised brands . . . brands that have *got* to be good. And he gives you prompt service. It adds up to savings in time and money—for *you.*

TUBE TURNS' Distributors and TUBE TURNS, INC. are united in their determination to serve you efficiently. Authorized TUBE TURNS' Distributors are located in all principal cities.

tt
TUBE-TURN

Be sure you see the double "tt"

"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO . . . A wholly owned subsidiary of TUBE TURNS, INC.

RUGGEDLY BUILT

for LOW-COST SERVICE

DESIGNED TO MEET MODERN INSTALLATION, SERVICE AND INVENTORY DEMANDS, TACO CIRCULATORS PROVE TOP DOLLAR VALUE

EXCLUSIVE FEATURES SPELL QUALITY CONSTRUCTION

LARGE POWERFUL MOTOR. Has power to spare. Overload protected and resiliently mounted for quiet operation.

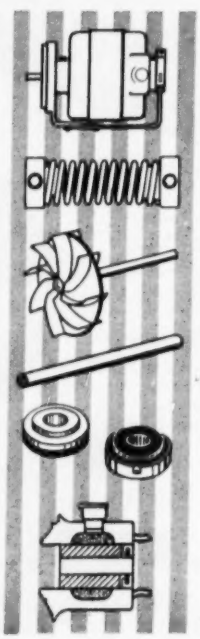
STRONG FLEXIBLE DRIVE SPRING isolates impeller from motor for quiet vibrationless operation.

CAST BALANCED IMPELLER (Not stamped). Casting the impeller in one piece makes certain of long uninterrupted service.

HARDENED GROUND STAINLESS STEEL SHAFT. Made to a plus tolerance of zero and minus tolerance of .0004. Then superfinished for long life smooth operation.

PATENTED ROTARY SEALS. Highest quality rotary seals make for trouble free operation.

POROUS BRONZE BEARING-LARGE OIL RESERVOIR. Long porous bronze bearing lubricates impeller shaft while keeping it in perfect alignment.



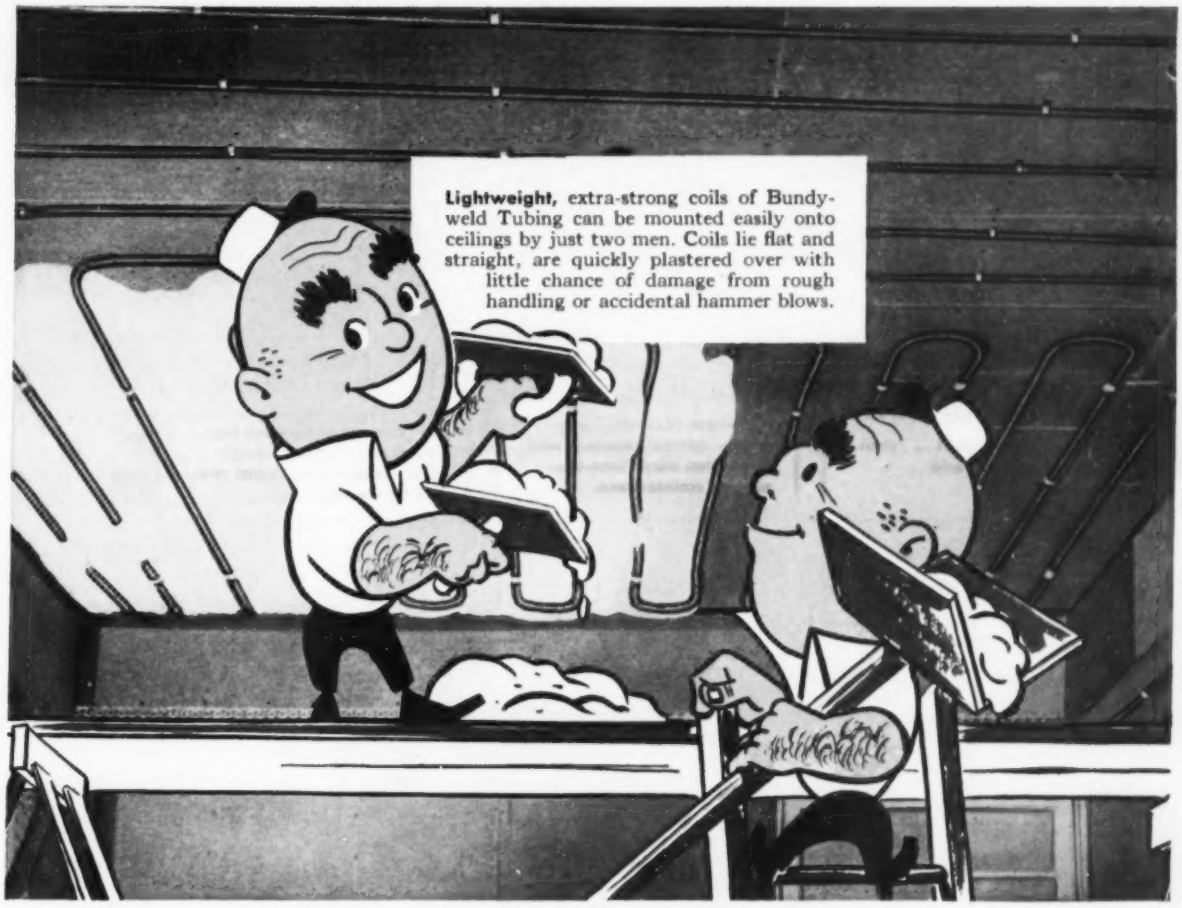
Contractors and big users alike are enthusiastic about the new Taco Circulators — and with good reason. This big-value line is specifically designed to meet the needs of the heating market of *today:*

Extra capacity for small pipe radiant heating jobs — radiator, convector, baseboard or panel. Just one size circulator to stock and use — with ¾", 1", 1¼" and 1½" interchangeable flanges to handle any job.

Easy to service — seals replaced with only an open end wrench, screwdriver and Allen set screw wrench. Quiet — no velocity noises regardless of flange size. Designed for six position installation, the new Taco circulator comes in special window carton with flanges individually packed for quick changing.

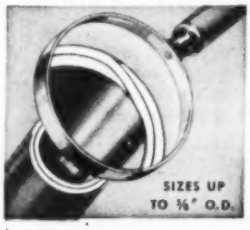
Better Heating-Better with Taco

TACO HEATERS, INCORPORATED, 137 SOUTH STREET, PROVIDENCE 3, R. I.



Lightweight, extra-strong coils of Bundyweld Tubing can be mounted easily onto ceilings by just two men. Coils lie flat and straight, are quickly plastered over with little chance of damage from rough handling or accidental hammer blows.

Want to pull ahead of competition? Do it with Bundyweld Ceiling Radiant Heating



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Pull ahead of your competition and stay ahead—with Bundyweld Ceiling Radiant Heating. It's so comfortable, convenient and economical, it's making other heating methods obsolete.

It's today's big heating news—already drawing heavy interest and growing every day. Thousands of people now living with Bundyweld Ceiling Radiant Heating are spreading the good news to friends. Too, our full-page ads in *Better Homes & Gardens, House Beautiful,* and *American Home* are going to millions of readers. They, in turn, are bombarding us with coupons, requesting literature.

More important to you, they're asking for the names of plumbing and heating contractors who handle Bundyweld Ceiling Radiant Heating in their neighborhoods. Why not send coupon for free information today?

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

SEND FOR FREE LITERATURE!

Bundyweld Ceiling Radiant Heating

Radiant Heating Division, Dept. HP-253
Bundy Tubing Company, Detroit 14, Mich.

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.
☐ Send Bundy technical radiant heating pamphlet.

Name _____ Title _____
Company _____
Address _____
City _____ Zone ____ State _____

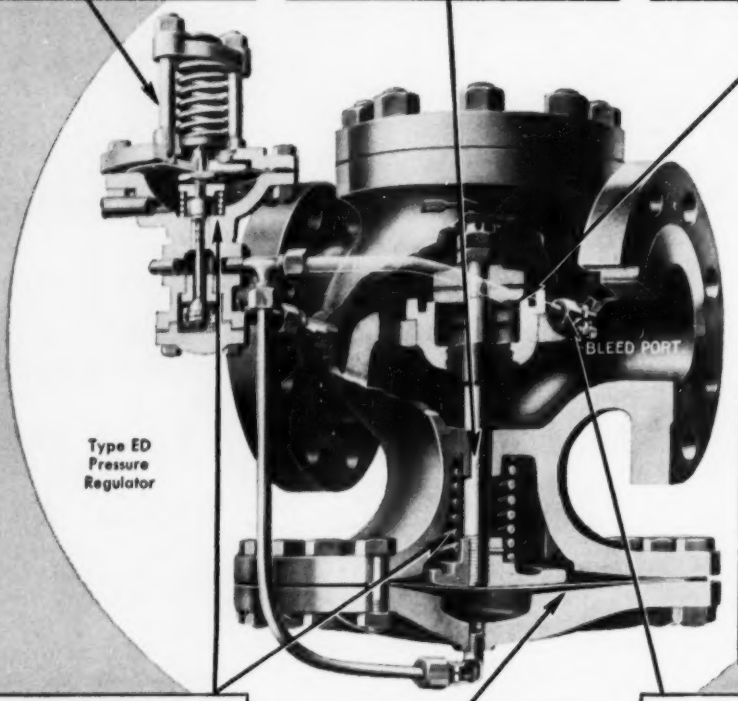
ONLY SPENCE REGULATORS

...give you all these design advantages

Separate Interchangeable Pilot . . .
controls main valve . . . simplifies inspection and maintenance.

Packless Construction . . .
minimizes friction . . . improves control accuracy and eliminates much time-consuming maintenance.

SECO Metal Seats and Discs . . .
resist wiredrawing. More than 20 years of experience has failed to produce a single case where SECO Metal was cut by steam.



Type ED Pressure Regulator

Dead-End Shutoff . . .
guaranteed on steam service when a balanced, single-seated main valve is equipped with SECO Metal seat and disc and is protected by an approved strainer.

Internal Springs . . .
out of path of steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life.

Large Balanced Metal Diaphragms . . .
located in a cooled zone with a condensate seal above and below, under usual conditions, never need replacement.

Ease of Inspection . . .
quick access to all vital elements of regulator. No special tools needed.

These Spence design features explain why Spence Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention. This lowers over-all costs . . . means less down-time of the system. • Spence makes a complete line of automatic regulating valves: pressure reducing, differential pressure, back pressure control, pump governor, temperature regulating and other types. Write for Bulletin giving full details.

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Engineered "Wool" . . . to keep a baby warm!

Lucky baby!

You can sleep like a top under your soft Dynel blanket. For it's as warm as wool, yet it has properties a sheep never dreamed of . . . and they were engineered into it by modern chemical science. Dynel is strong, flame-proof, mildew- and moth-proof. It's light, and comes from the wash as fluffy as a kitten.

Dynel, Orlon, Dacron, Acrilan, Vicara, and other man-made "wonder" fibers are made from chemical solutions. These raw solutions must be kept absolutely pure as they pass through hundreds of valves that control their flow and regulate their proportions on the way to spinnerets, where these solutions are transformed into gossamer textile fibers. To guard against any contamination or discoloration resulting from valve corrosion, the manufacturers of Dynel and other new synthetic fibers use ALOYCO Stainless Steel Valves.

Like the manufacturers of engineered fabrics, other leading chemical firms, handling everything from blood plasma to oil refinery sludge, have brought their problems of corrosion, contamination, discoloration, and extreme temperatures to *Aloyco's Corrosion Engineering Service.* There, in the laboratories of the world's largest specialists in corrosion-resistant valves, the right alloy and the right type of valve have been determined for every specific corrosive situation. In fact, ALOYCO valves go hand-in-hand with chemical progress.

So if corrosives play a part in your business, write to ALOYCO about your own valve needs. Our engineers will be glad to test various alloys under your actual line conditions, and on that basis, recommend the best valve for each particular assignment.

ALLOY STEEL PRODUCTS CO., INC.
1322 West Elizabeth Avenue, Linden, N. J.
Plants: Linden, N. J.; Bloomfield, N. J.; Elizabeth, N. J.

3.1

Longer Lasting
ALOYCO VALVES
1st in Corrosive Service

DISTRICT OFFICES

NEW YORK 1, NEW YORK — 350 Fifth Avenue
WILMINGTON, DEL. — 226 West Ninth St.
PITTSBURGH 22, PA. — 318 Investment Bldg.
ATLANTA, GEORGIA — 333 Candler Bldg.
ST. LOUIS, MISSOURI — 1221 Locust St.
CHICAGO 4, ILLINOIS — 332 So. Michigan Ave.
HOUSTON 6, TEXAS — K. E. Luger Co. 2716 Danville St.
SAN FRANCISCO, CALIF. — 24 California St.
LOS ANGELES 22, CALIF. — 5442 Jillson St.

Steam...
or
Gas-fired...
Built in Horizontal (illustrated), Vertical Delivery and Power Throw types — 47 different models.
Five popular sizes, A.G.A. approved for natural, mixed, manufactured, L.P. and L.P. air gases.

Modine builds a unit heater to match your heating requirements

Whether it's steam, hot water or gas . . . look to Modine for the *right* unit heater

WHATEVER your unit heating requirements, you can match them exactly from the complete Modine line. Because Modine builds steam, hot water *and* gas-fired units, you're sure of an unbiased recommendation. And, remember, when you buy Modine, you buy the greatest name in unit heating. As a leader in this field for more than 25 years, Modine gives you balanced heating performance — perfect heating comfort plus maximum fuel economy. Get all the facts. See the Modine representative listed in your classified phone book, or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis.

Modine STEAM AND HOT WATER UNITS

Special heating coil designs for steam and for hot water assure best performance for each type of system. Discharge air temperatures of 110-120° F are correctly related to air velocity for heating at its best. All-copper coils defy corrosion because fins are bonded to tubes and tubes are brazed to headers. Pre-formed tubes with individual expansion bends absorb stresses, assure long life.

Modine GAS-FIRED UNITS

Modine is the only gas unit with both *stainless steel* heat exchanger and burner. Lighter weight means easier, less expensive installation, plus faster heat delivery — *within five seconds* after thermostat calls for it. Individually fired tubes provide higher heat transfer. Elongated ports — four times free area of conventional drilled ports — minimize clogging and simplify routine cleaning. U-1186

Ask for Bulletin 149-A on steam and hot water and Bulletin 652 on gas unit heaters

Modine UNIT HEATERS

Men who know ducts INSIDE..

ULTRALITE DUCT LINER—ACOUSTICAL

This is the duct liner that **won't burn!**—a flexible, resilient, semi-rigid glass fiber insulation designed specifically as acoustical duct liner. Has excellent sound absorbing properties, particularly at the irritating noise levels. Won't break, flake or chip. Runs quickly around curves and corners. Friction loss is low. Won't delaminate under air movement; won't flake off in air stream.

ULTRALITE
DUCT INSULATION
and
DUCT LINER

have every characteristic that makes application easy and quick. They're light, flexible, resilient; you can cut them with a knife; run them quickly around curves and corners; adhere them to metal with adhesives . . . screws and washers . . . wires! Get full details on Ultralite and learn why it goes on faster, easier and cheaper than any insulation you've ever used!

..and OUT..

ULTRALITE DUCT INSULATION — THERMAL

A soft, resilient, flexible insulation of long, fine glass fibers with a low K-factor. Available plain or with your choice of 4 vapor barrier facings, already adhered to the insulation. Wrap-around method of application cuts applied costs way down. Non-irritating, pleasant to handle. Fire-resistant, non-corrosive to metals.

...use ULTRALITE throughout!

Call your local Ultralite Distributor (listed in the Yellow Pages).

GUSTIN-BACON MANUFACTURING CO.

210 W. 10th St., Kansas City, Mo.

New York • Chicago • Philadelphia • San Francisco • Los Angeles • Houston
Tulsa • Ft. Worth • Detroit • St. Louis

FULL COIL CAPACITY

regardless of load changes

ALCO

MULTI-OUTLET THERMO VALVES

They feed all circuits EQUALLY WELL... even with the load dropping and only 50% of the compressor on duty!

RESULTS: Evaporator delivers its rated capacity consistently, and the cost of additional coil surface is saved. Compressor running time and operating costs are reduced.

On many installations, coil capacity has been increased up to 35% by Alco Multi-Outlet Thermo Valves.

ALCO VALVES..."more service—less servicing"

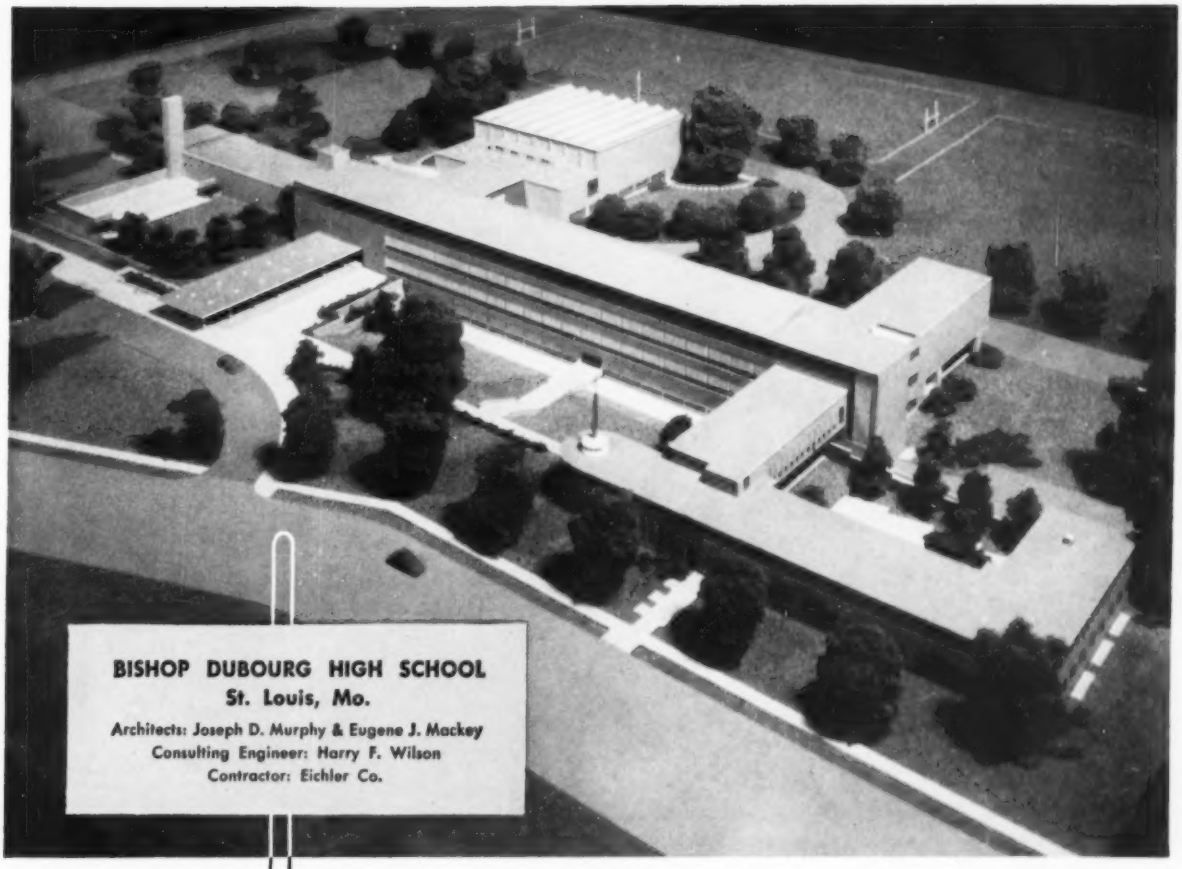
SEE YOUR ALCO WHOLESALER

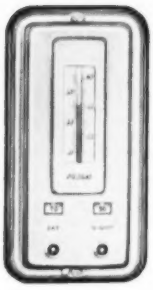
ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5310


BISHOP DUBOURG HIGH SCHOOL
St. Louis, Mo.
Architects: Joseph D. Murphy & Eugene J. Mackey
Consulting Engineer: Harry F. Wilson
Contractor: Eichler Co.



173 POWERS Day-Night Thermostats control 226 valves on Convectors and 69 Unit Ventilators.

Another Outstanding Modern High School

POWERS *Controlled*

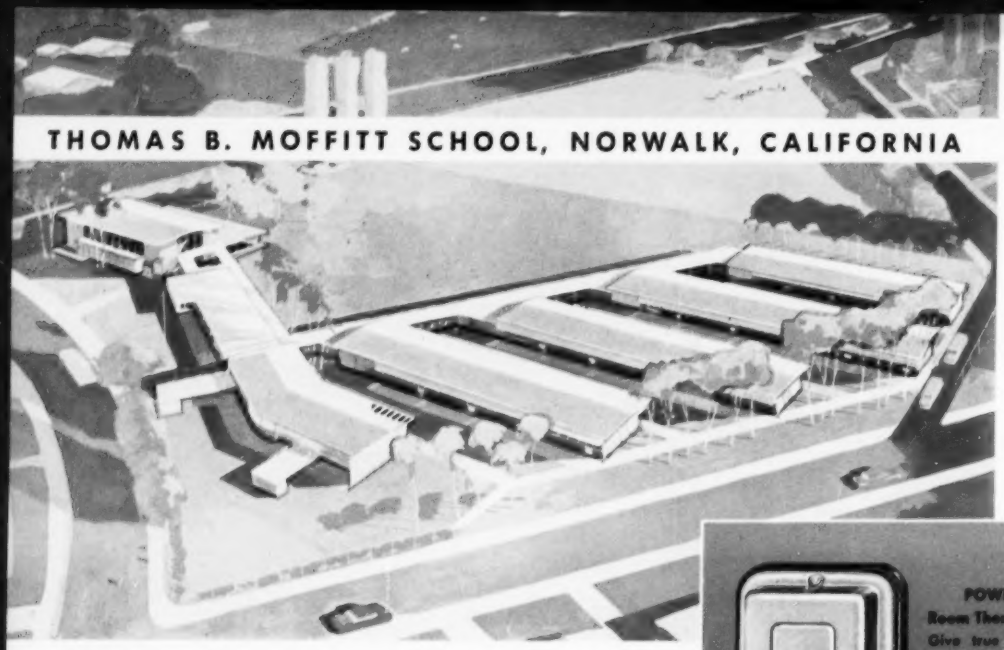
Among the many economical features included in the unique four story $3,000,000 Bishop DuBourg High School is a Powers pneumatic system of temperature control.

Superiority of Powers Unit Ventilator Control here will not only provide greater comfort but will hold down operating costs. Its continuous dependable operation is due to the basic simplicity of Powers Low-Limit Airstream Thermostats. They need no auxiliary devices to supplement their accurate control of Unit Ventilator discharge temperatures. Their adjustable sensitivity gives precise control.

Powers control of unit ventilators and convectors results in greater comfort and fuel economy. With today's high fuel cost Powers temperature control is a more profitable investment than ever before. When problems of temperature control arise contact Powers nearest office. Our more than 60 years of experience may be helpful to you.

(b7)

Established in 1891 • THE POWERS REGULATOR COMPANY • SKOKIE, ILL. • Offices in Over 50 Cities

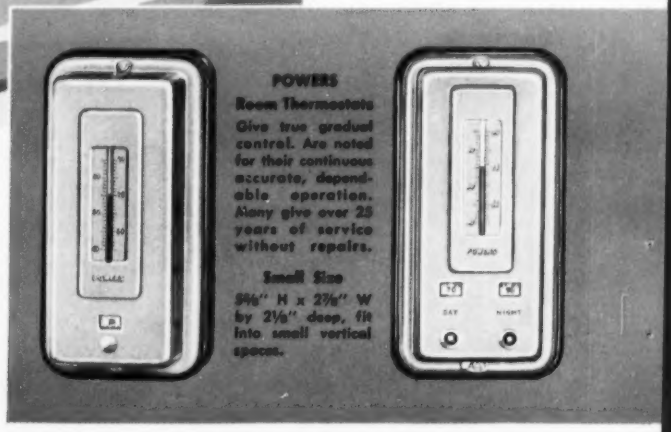


THOMAS B. MOFFITT SCHOOL, NORWALK, CALIFORNIA

Architects
KISTNER, WRIGHT and WRIGHT
(Successors to Kistner, Curtis and Wright)

Chief Mechanical Engineer
CHESTER D. WALZ

Heating Contractor
DAVIS PIPING CO.,
Whittier, Calif.



POWERS
Room Thermostats
Give true gradual control. Are noted for their continuous accurate, dependable operation. Many give over 25 years of service without repairs.

Small Size
5⅝" H x 2⅞" W by 2⅛" deep, fit into small vertical spaces.

POWERS

Pneumatic Systems of TEMPERATURE CONTROL

Installed in These Modern Elementary Schools

IN 1978 – these and hundreds of other schools on their silver anniversary very likely will award "A's" to Powers "for dependable temperature control with a minimum of maintenance."

25 to 40 years of reliable low-maintenance-cost service is frequently reported by Powers users. Some installations made in 1901 to 1910 are still in operation and giving good control. Recent design improvements in Powers equipment will not only give better control but an even longer life expectancy . . . greater comfort and lower operating costs. When you want help in selecting the type of temperature control best suited for your requirements — contact Powers nearest office. There's no obligation.

Established in 1891 • THE POWERS REGULATOR COMPANY • SKOKIE, ILL. • Offices in Over 50 Cities

(b5)

MODERN CONTROLS FOR MODERN SCHOOLS

POWERS NO-PAK PACKLESS VALVES

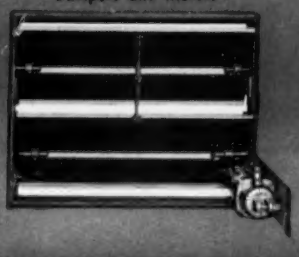
. . . require no maintenance of packing. They prevent leakage of water or steam

VARIOUS TYPES AND SIZES FOR ALL REQUIREMENTS

Powerful Small Top Valve, with angle or straight-way union; Reverse Flow Angle with double female unions; also flared ends and screwed end bodies.

Airstream Thermostat for Unit Ventilators

Complete line of modern Dampers and Motors



MASTROL System for controlling forced hot water heating

METAFLOW Control Valve

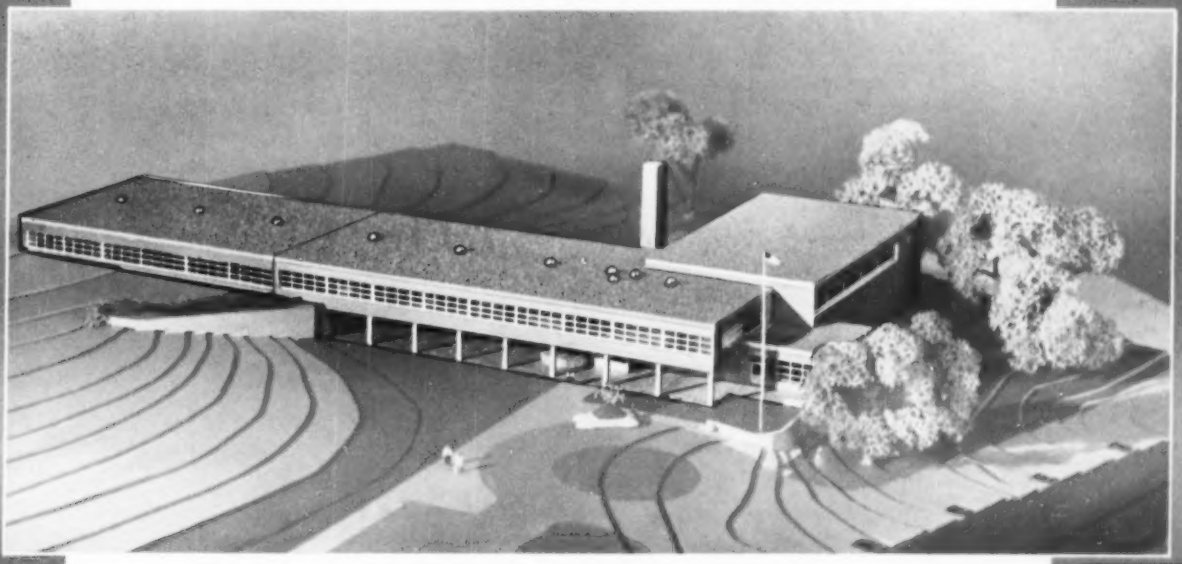
Right: FLOWRITE Neoprene Diaphragm Control Valve

Architects: ADE and TODD
Consulting Engineers: ROBSON & WOESE
Contractor: W. A. McCORMICK

Above: HILTON CENTRAL SCHOOL, HILTON, NEW YORK

POWERS

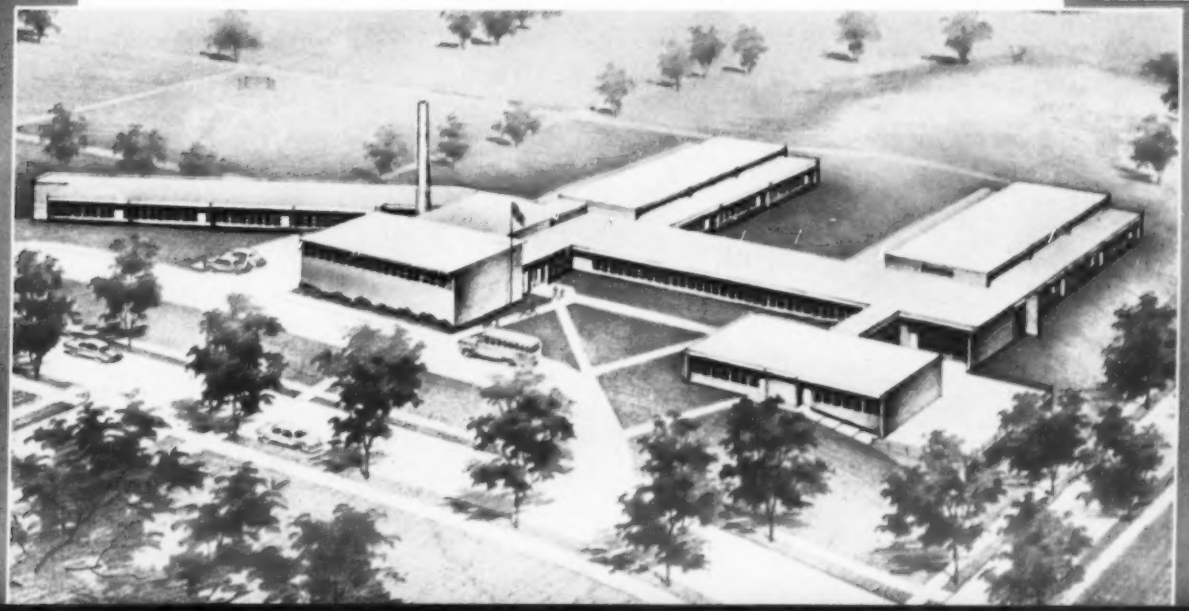
Below: LEE ELEMENTARY SCHOOL, MANHATTAN, KANSAS



Architects and Engineers
E. O. WOLFENBARGER & ASSOCIATES
Contractor: WOODHULL PLUMBING CO.

—Below: MAUDE ARMITAGE ELEMENTARY SCHOOL, MINNEAPOLIS, MINNESOTA—

POWERS



Architects and Engineers: MAGNEY, TUSLER and SETTER and PERKINS & WILL
Contractor: H. R. NICHOLS PLBG. & HTG. CO.

Seattle's Efficient

MODERN SCHOOL ADMINISTRATION BUILDING*

Equipped with POWERS Temperature Control

Taxpayers in Seattle may well be proud of this attractive building for it is an outstanding example of the trend to provide school executives with facilities as efficient and modern as the schools under their supervision.

In the executive offices, conference rooms, library, audio-visual, child guidance, medical service and P. T. A. divisions, cafeteria, 200-seat auditorium and other spaces right-temperatured-air is assured by a Powers Pneumatic Control System.

Architects: J. Lister Holmes & Associates
Engineers: Marius Anderson & Associates
All of Seattle, Wash.

*Received Honor Award from Washington State Chapter A.I.A.

Dearborn-Massar Photos

POWERS Pneumatic Systems of Temperature Control

. . . prevent OVER-heated rooms. Greater comfort, lower fuel bills and many years of dependable service make Powers control a highly profitable investment. Contact our nearest office for help in solving your temperature control problems.

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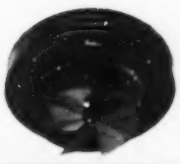

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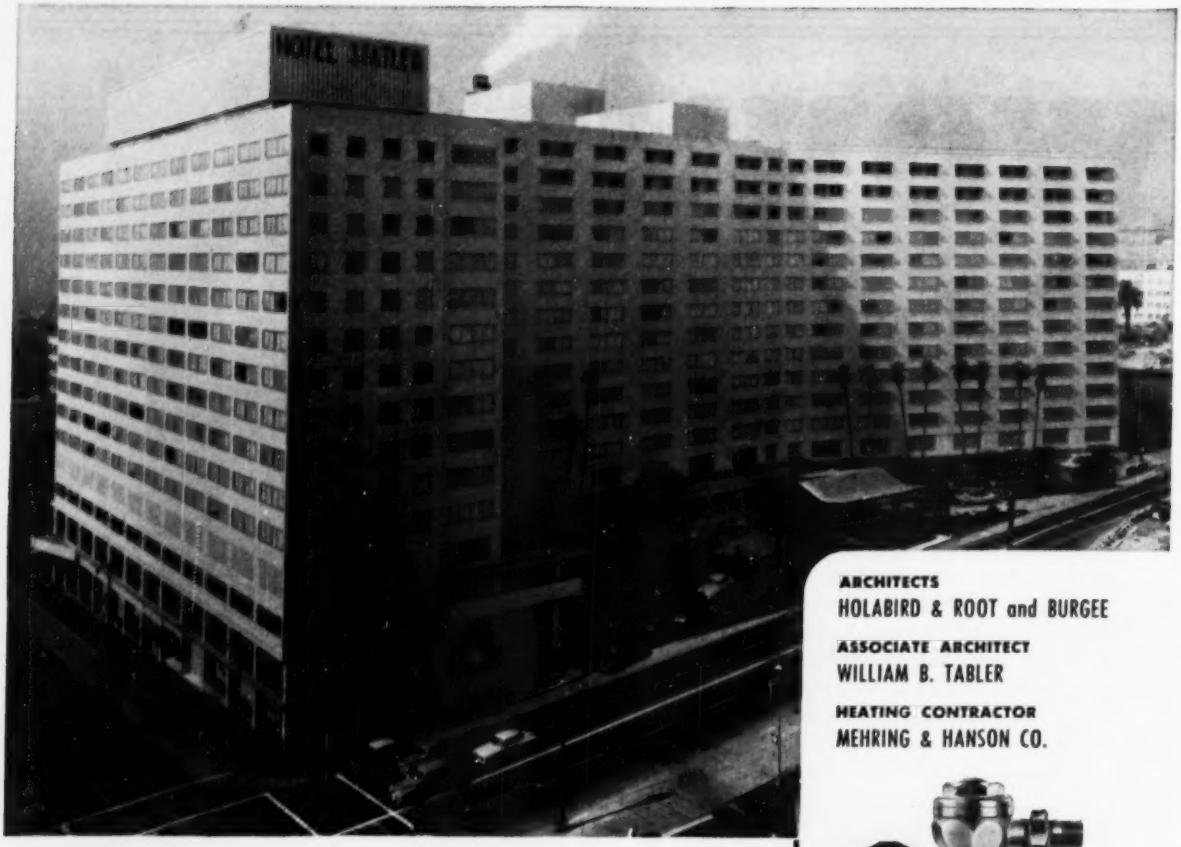

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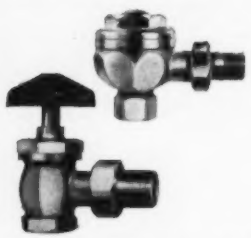
At the New Statler Center, Los Angeles

MARSH VALVES AND TRAPS

A lot of new thinking and long, hard planning went into this new Statler Center. It is a unique combination of hotel, office building, garage and shops all in one. It is distinctive alike for the open character of its design, and for the handling of such considerations as ventilation, heating and air conditioning.

The selection of Marsh valves and traps for such a building speaks for itself.

Long known and long respected, the Marsh line offers assurance of dependable service, year in and year out. For your very next job, learn first hand the advanced design and construction that have made Marsh valves, traps, vents and controls first choice for so many of the nation's finest buildings.



The Marsh metal-to-metal seal gives you packless valve construction at its finest. Perfect team-mate for it is the Marsh radiator trap. A large number of these were used in the New Statler.

This Marsh float and thermostatic trap is typical of a wide line of Marsh traps for all services.

MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*

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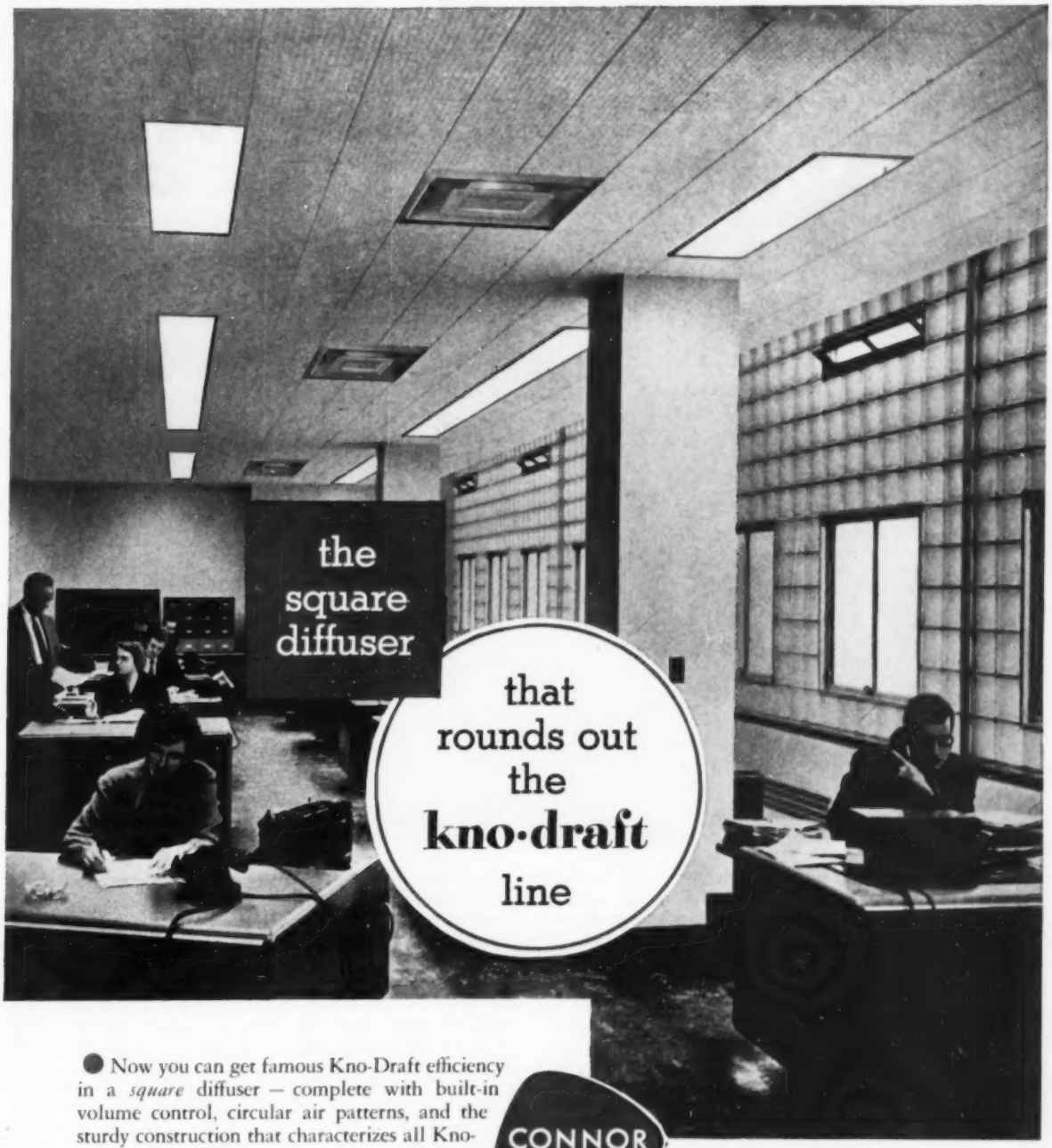

● Now you can get famous Kno-Draft efficiency in a *square* diffuser — complete with built-in volume control, circular air patterns, and the sturdy construction that characterizes all Kno-Draft Air Diffusers.

The picture shows the Kno-Draft *Square* Diffuser, Type KPT, designed for T-bar installations. It snaps easily and snugly into perforated acoustical-type ceilings. For overlapping installation, Type KP is the unit to use.

Heating and air conditioning men who have installed the new Kno-Draft *Square* Diffusers will tell you these handsome units do an outstanding job. Naturally. They're made by men who have been "engineering air" for more than twenty years.

Quickest way to get full engineering information on Kno-Draft *Square* Diffusers is to clip the coupon and mail it to W. B. Connor Engineering Corporation, Danbury, Connecticut.

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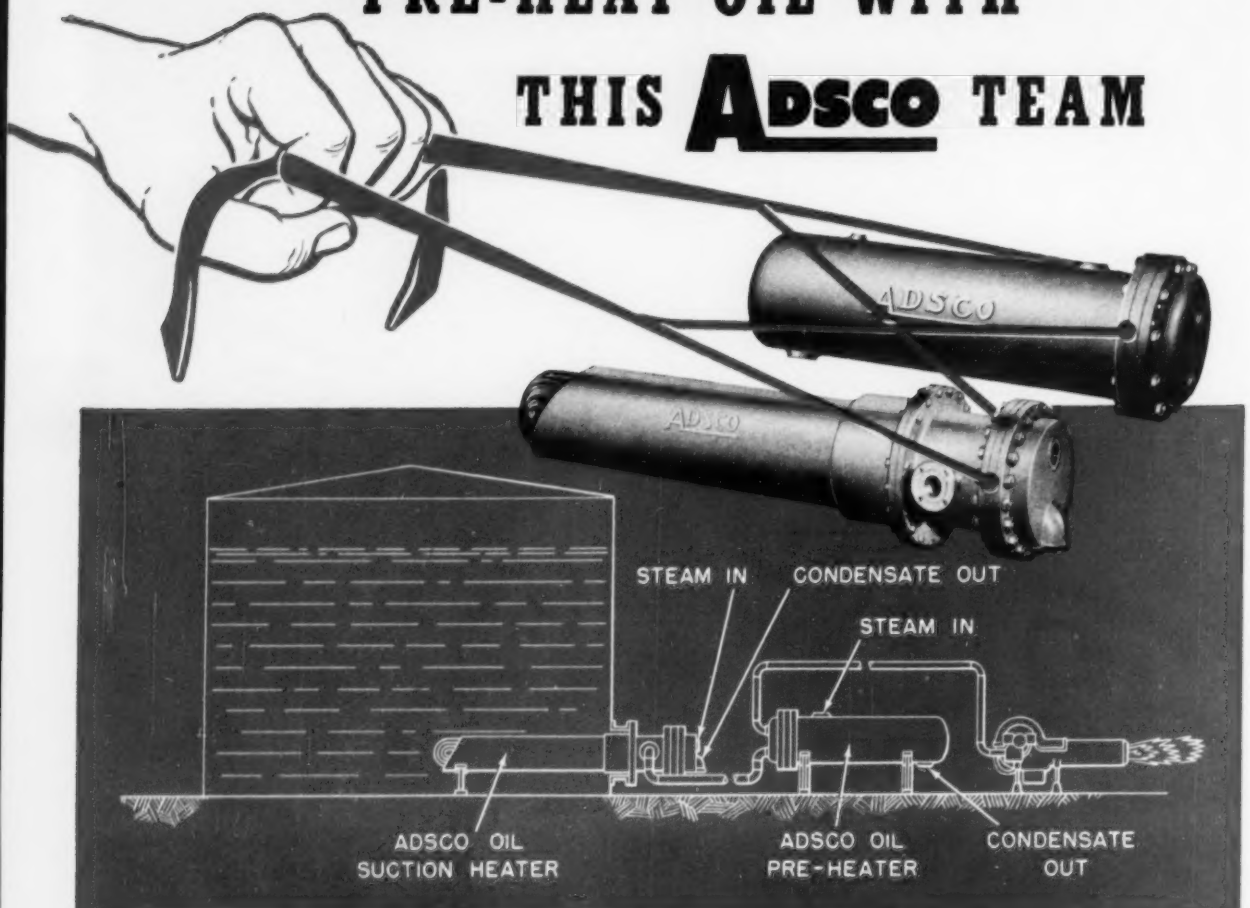
PRE-HEAT OIL WITH THIS ADSCO TEAM



▶ Two important jobs to be done in a fuel oil system are warming the fuel oil in the storage tank so it will move easily through the pipes and then pre-heating it for thorough atomization in the burner. These two jobs are done well with an ADSCO Oil Suction Heater and an ADSCO Oil Pre-Heater. The suction type heater is the modern, efficient method of reducing the viscosity of heavy oil so that it can be pumped economically. Instead of raising the temperature of all the oil by old-fashioned pipe coils on the bottom of the tank, only the oil to be pumped is heated. This eliminates excessive waste of steam by tank radiation losses. ADSCO Pre-Heaters assist in obtaining the highest performance from heating oil by preparing it properly for complete combustion in the burner. In many cases, the work done by ADSCO Oil Suction Heaters and Oil Pre-Heaters permits the use of a lower-grade, less costly fuel oil... For more details, call your ADSCO representative or write the factory. ADSCO Oil Suction Heaters and ADSCO Oil Pre-Heaters are made in many sizes with different metal combinations for shell and tubes. They are manufactured with the same insistence on quality which distinguishes all ADSCO products. ADSCO'S engineering staff is available for work on all types of special heat transfer problems. All recommendations are based on many years of practical experience.

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EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS
STRAINERS • SEPARATORS • METERS

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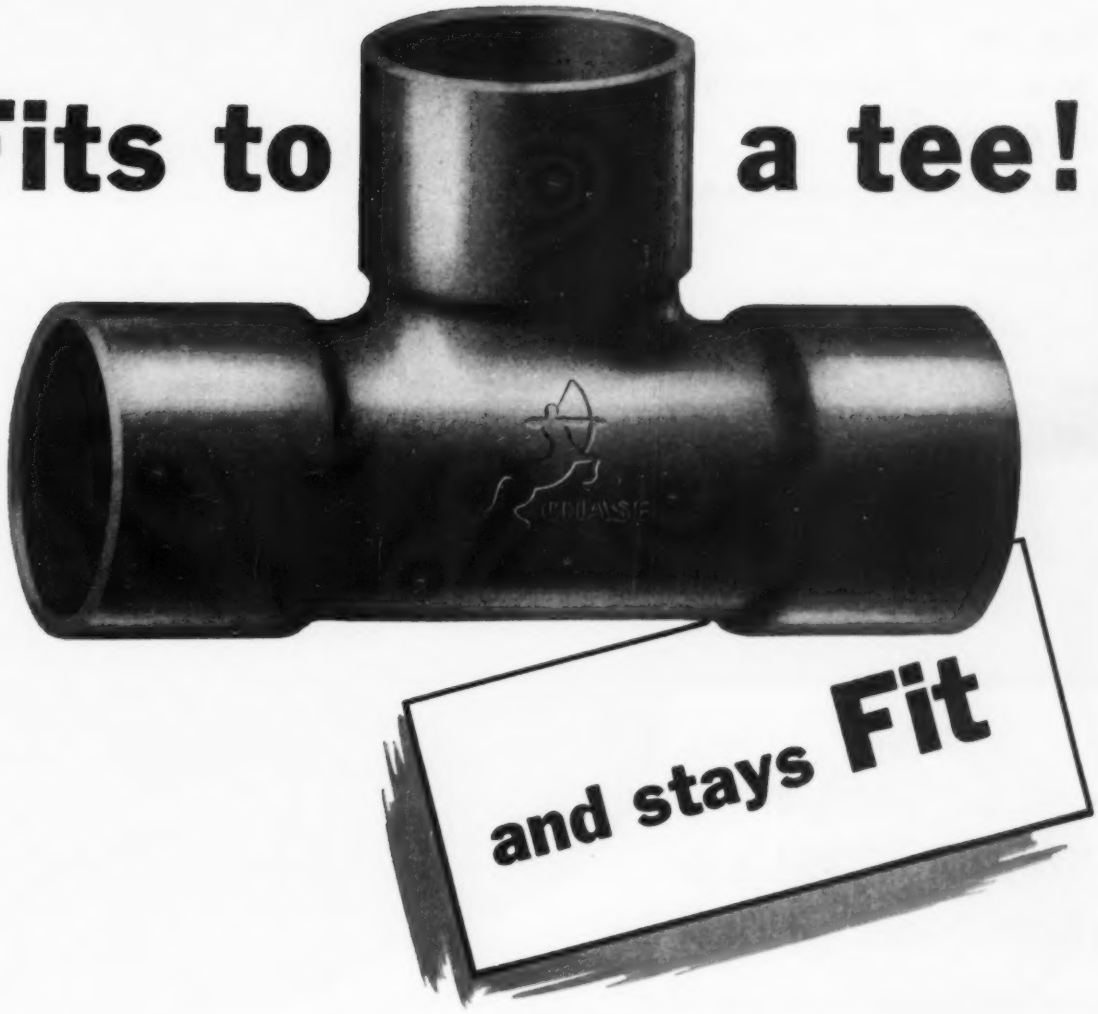

even under 5,000 pounds per square inch pressure

It takes only minutes to make a Chase solder-joint that will stand up for years. In actual tests on assemblies of one-half inch Chase Copper Tube and Chase Solder-Joint Fittings, they have withstood over 3,400 pounds pull and 5,000 pounds per square inch water pressure.

Chase Flared Connections, too, are easy to make, tough to pull apart. Of course, all Chase fittings are corrosion-resistant, won't clog with rust. So for anything from drainage lines to radiant panel heating, be sure you specify Chase Copper Tube and Fittings. They assure better flow, longer life.

Write today for Free Chase Catalog on Solder-Joint and Flared Copper Tube Fittings.

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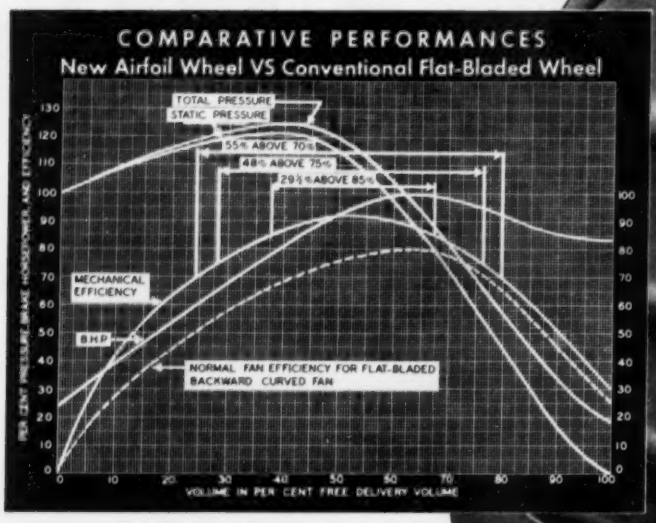

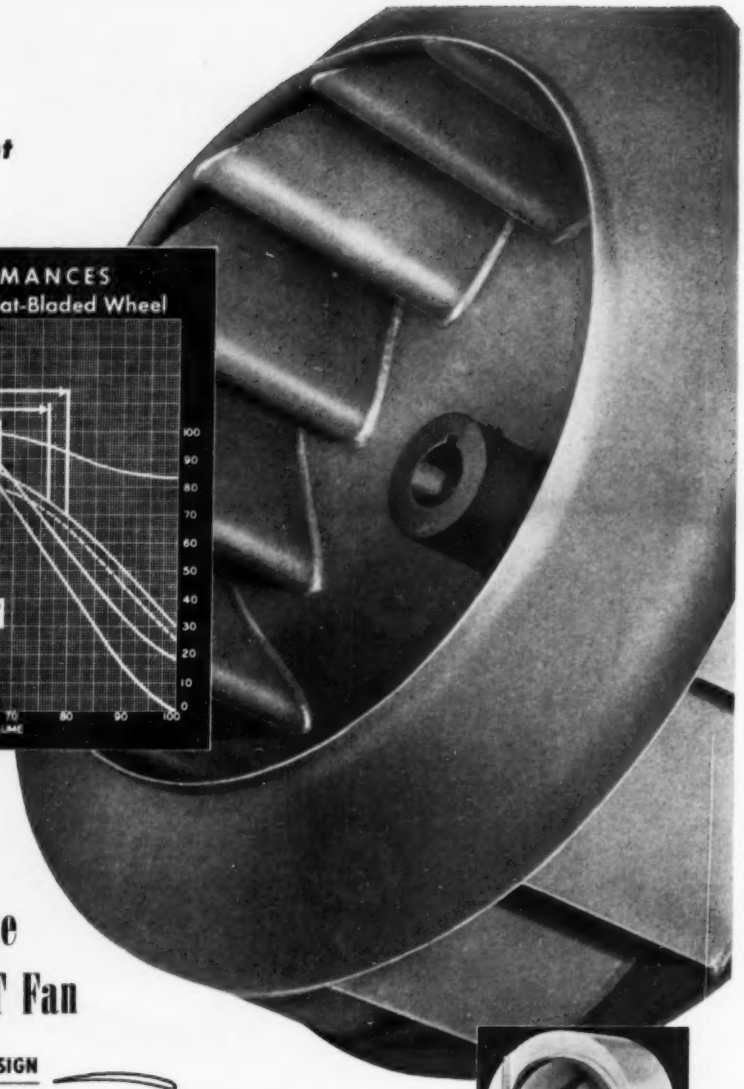

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REVOLUTIONARY NEW AERODYNAMIC BLADE DESIGN

the only really new improvement since the original development of the backward curve non-overloading type fan. Meets *all* normal heating, ventilating and air conditioning requirements . . . *plus* high pressure ventilating systems . . . *plus* induced and forced draft applications.

EXCLUSIVE hollow-sectioned airfoil blades of this backward curve type wheel provide the greatest volume and the smoothest flow of air possible at an unmatched noise level.
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CERTIFIED ratings. All drives, directions of rotation and discharge. 600 to 750,000 cfm. ⅛ to 16" sp. Class 1 to 4 construction. Wheels 12¼ to 132" diameter.

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COMPLETE PROVED-PERFORMANCE LINE

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The centrifugal pump to handle your job to satisfaction and at lowest power and upkeep cost is shown or described on this page.

"Buffalo"

Pumps are not built to sell cheaply, but to operate cheaply. That is where pump savings are made. May we suggest that you and your staff write us for engineering bulletins on any pumps you need. Then look into the long-life features like oversize "Buffalo" bearings, shafts and stuffing boxes. See the accessibility of all parts, the high efficiency impeller design. You'll see why "Buffalo" Pumps save money!

BUFFALO PUMPS, INC.
171 MORTIMER STREET BUFFALO, NEW YORK
Subsidiary of Buffalo Forge Co. Canada Pumps, Ltd., Kitchener, Ont.

...and DID YOU KNOW that you can get a "Buffalo" Fan of the exact size and type you want — for ventilation, blowing, exhausting, draft, air conditioning supply. "Buffalo" has been First For Fans for 75 years. You're safe in specifying "Buffalo" for your air handling needs!

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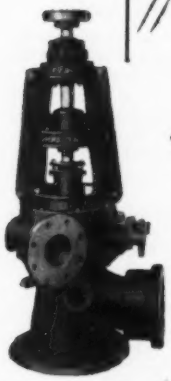
"Buffalo" PUMPS



NON-CLOGGING SEWAGE PUMPS
For trouble-free sludge circulation, agitation and removal. Vertical or horizontal models. Request Bulletin 960-G.

SUMP PUMPS
Complete units ready to install. No stuffing boxes required. Ball bearing thrust and enclosed shaft.
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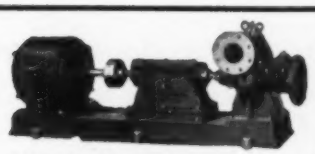
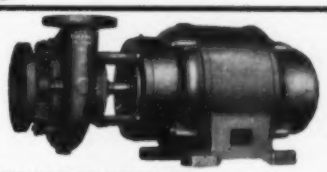


PAPER STOCK PUMPS
A pump for every liquid, consistency and head. Non-clogging enclosed impellers retain initial efficiency. Mill-proven for many years. Bulletin 953.



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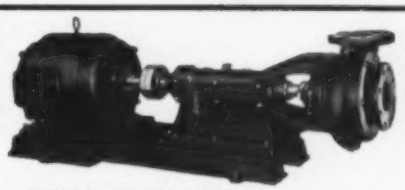
Compact, sturdy, easily installed. Shafts in permanent alignment. Bulletin 975.



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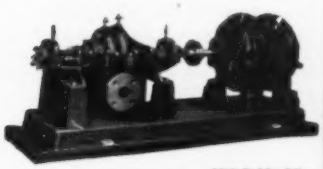
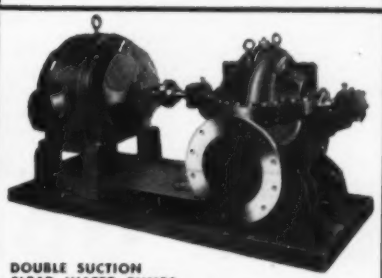
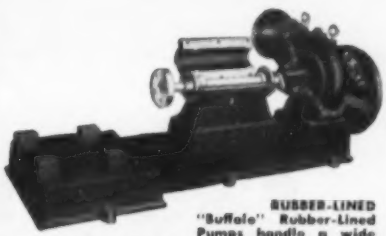
Suitable for construction in most machineable alloys. Full ball bearing single suction. Bulletin 982.



MULTISTAGE CLEAR WATER PUMPS
for pressures up to 500 psi, any temperature. Rugged, efficient, popular boiler feed pumps. Bulletin 980. "Buffalo" also manufactures automatic condensate pump and receiver units.

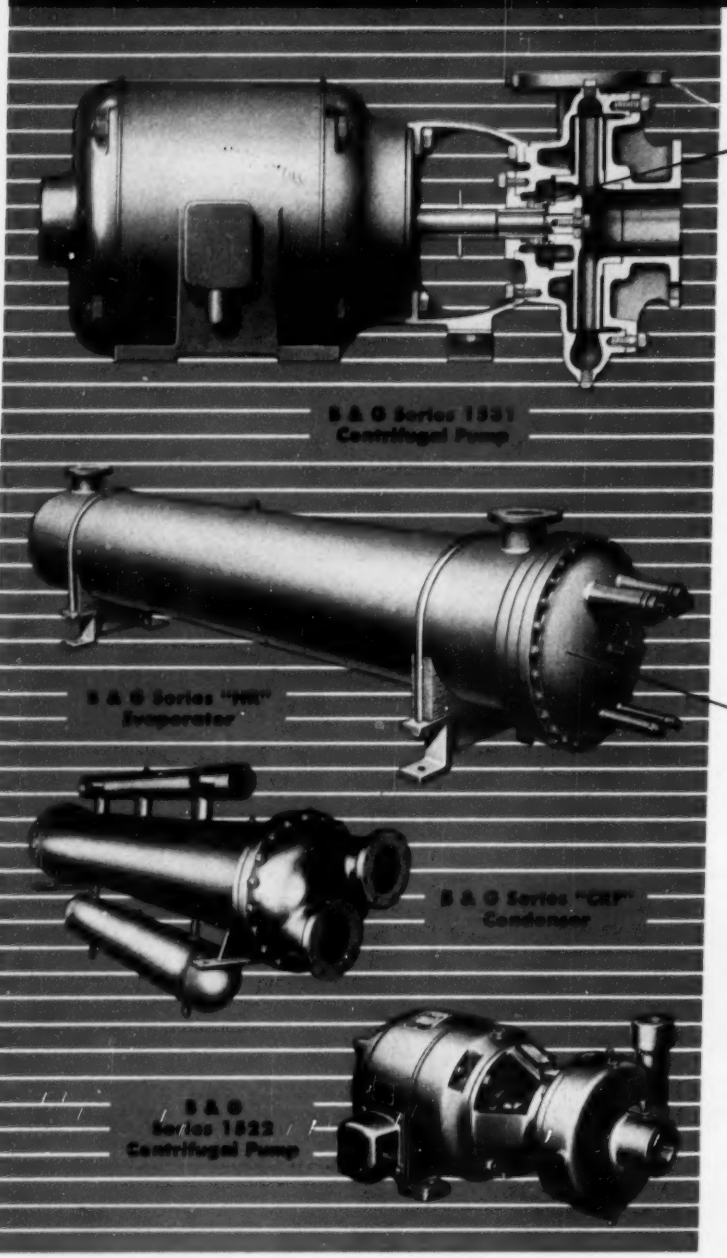


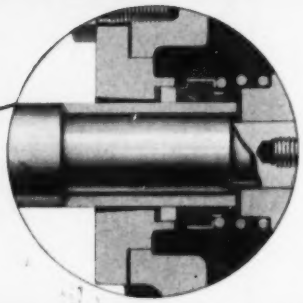
DOUBLE SUCTION CLEAR WATER PUMPS
are hydraulically balanced and of finest obtainable construction. Also available in self priming models. Bulletin 955.



RUBBER-LINED
"Buffalo" Rubber-Lined Pumps handle a wide variety of acids, caustics and liquids containing abrasives. All pump parts contacting liquid are covered with the proper grade of rubber. Bulletin 953-G.

Plus Value REFRIGERATION AND AIR CONDITIONING EQUIPMENT



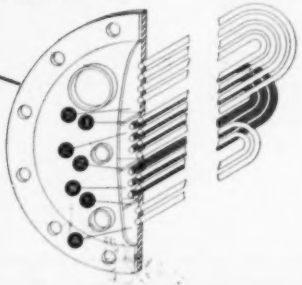


B & G 1531 UNI-BUILT PUMP WITH NEW *REMITE* SEAL

Here's a revolutionary new development in pump design...a *plus value* which eliminates leakage—assures long, trouble-free life.

A carbon seal ring faces on a "REMITE" floating seat—a new type of material, *so hard it will scratch glass*—wear-proof and corrosion-resistant. This feature alone makes the 1531 the "buy" for refrigeration and air conditioning installations.

Measure the B & G Series 1531 Pump by any standards you choose...you'll agree that never before have you seen so many warranties of top performance.



B & G SERIES "HR" EVAPORATOR

You'll find *plus value* in the unique design of this evaporator which prevents oil-trapping in the head passes. The diagram above shows how the lower tubes in each pass are located very close to the baffle plate, permitting any oil entering the passes to travel freely with the Freon vapor back to the compressor.

Other features include movable steel legs, for easy mounting under various conditions. The shell connections extend well beyond the insulation cover—assure easy installation.

Send for complete file of Catalogs

B & G Catalogs on Centrifugal Pumps, Evaporators, Condensers and Heat Exchangers give full information on the latest in air conditioning and refrigeration equipment.

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a good address

Rittenhouse Claridge
Philadelphia

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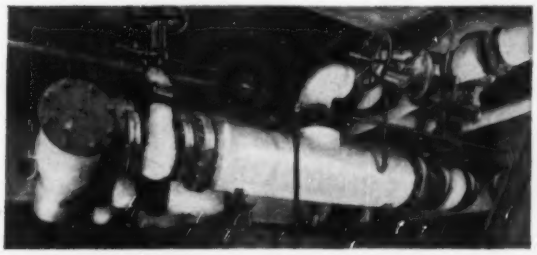
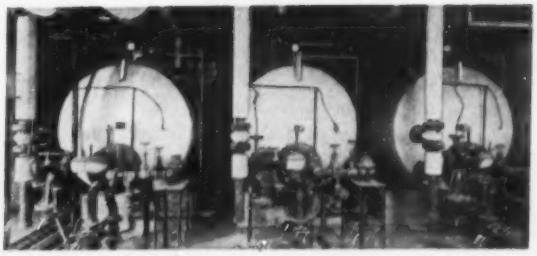
where p-k equipment is at home.....at work

This new, modern apartment house is well equipped to supply its 482 tenant-families with adequate heat and clean, hot water—and the same p-k equipment keeps pavement areas free of snow in winter time. Like many other modern apartment owners, p-k equipment was chosen by the owners of the Rittenhouse-Claridge for efficient, dependable, economical operation.
Full information and engineering help is yours for the asking. Write today.



Three Type O p-k single pass Hot Water Converters are in use at the new, modern Rittenhouse-Claridge. Each heats 785-gpm of water from 160°F to 180°F with steam at 25 psig.



Three 60" x 168" Type B p-k Storage Heaters are used. Each has a live steam section to heat 3600 gph from 40°F to 180°F with steam at 5 psig and a condensate cooling element with 75 sq. ft. of surface.

the **Patterson-Kelley Co., Inc.**
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leaders in heat transfer equipment since 1880

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NEW All-Purpose Gate Valve

● Use it for hot and cold water lines or low pressure steam—in plumbing, heating, and air conditioning systems—in homes, apartments, restaurants, offices, stores, hospitals, industrial plants.

The strong, amply-sectioned body will not distort nor will seat warp under soldering temperatures. The R-P&C Bronze Solder End Gate Valve has full, unobstructed flow. For use with K, L, and M copper tubing. Working pressures: steam —125 lbs.; cold water, oil, or gas (non-shock)—200 lbs.

Your R-P&C distributor has them—or can get them for you. Your nearest R-P&C district office will gladly furnish details of this and other R-P&C Valves. Call your distributor or write us today.

No. 90 R-P&C Bronze Solder End Gate Valve

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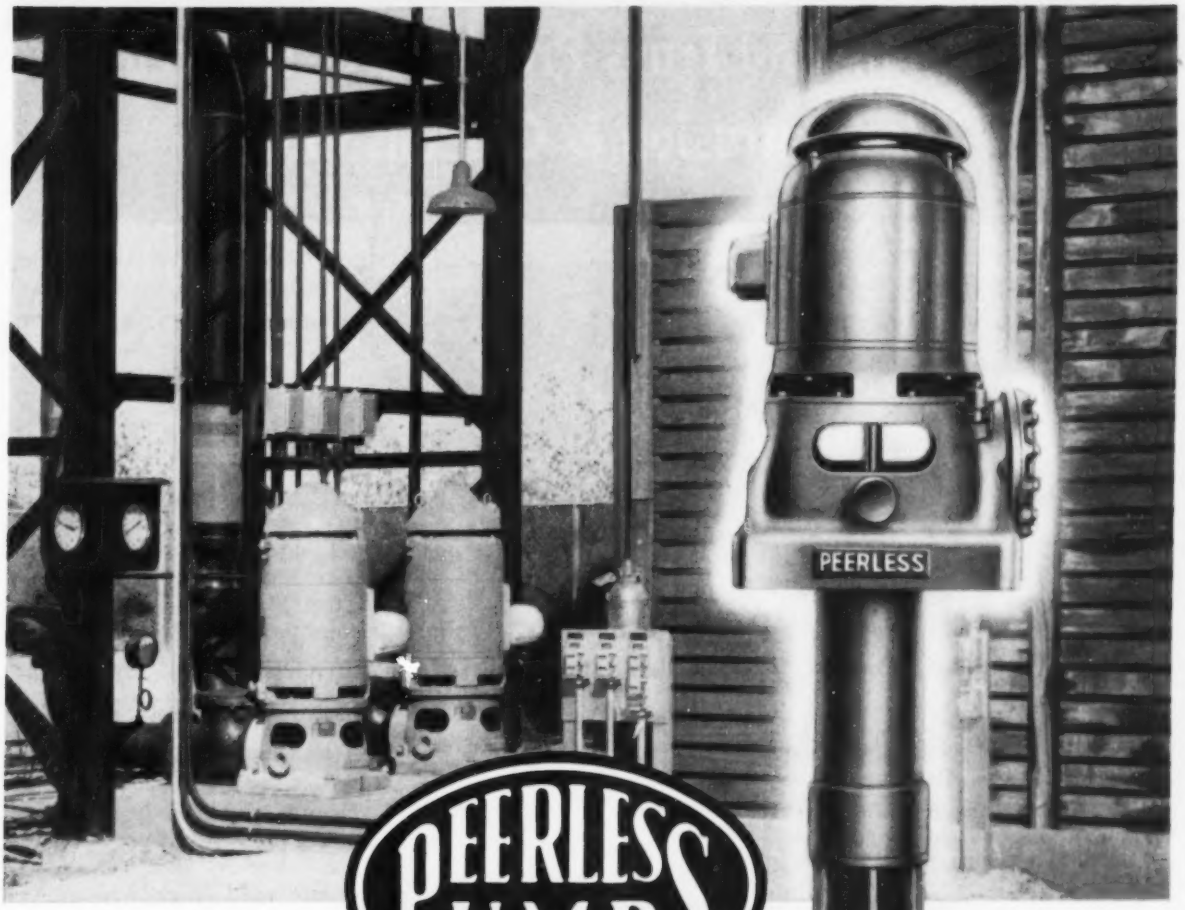
PEERLESS CLOSE-COUPLED PUMPS



PEERLESS PUMPS

Here's why

YOU CAN PROFITABLY APPLY *Peerless* VERTICAL PUMPS TO COOLING TOWERS

1 *YOU ELIMINATE SUCTION PIPING* **2** *YOU ELIMINATE PRIMING PROBLEMS* **3** *YOU SAVE INSTALLATION SPACE*

Not only is the Peerless vertical design a definite space saver over other pump types but it eliminates much of your piping and fitting costs and once primed, this vertical turbine pump is always primed; fear of running the pump dry is no hazard here. A vertical close-coupled pump is also best suited to adaptation to future system demands. Furthermore, it's the easiest of all pumps to service, maintain and adapt. NPSH required for operation may be adjusted to available NPSH in most installations because of the flexibility of this vertical design. A minimum of submergence is required for operation. Peerless field engineering service on vertical cooling tower pump designs is nation wide. Consult with the Peerless sales office or distributor nearest you. They can be of help in cooling tower sump design as well as pump and driver selection to obtain the most efficient and trouble-free cooling tower pumps. Or mail the coupon today for full information.

Capacity: 30 to 30,000 GPM

Head: Widest head range —from minimum to 1000 feet

Impeller: Special hydraulic design for low NPSH

Drives: Standard and explosion proof vertical pump motors. Also vertical and horizontal (right angle) steam turbine and right angle stationary engine drives.

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PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send complete data on vertical close-coupled pumps for cooling tower service.

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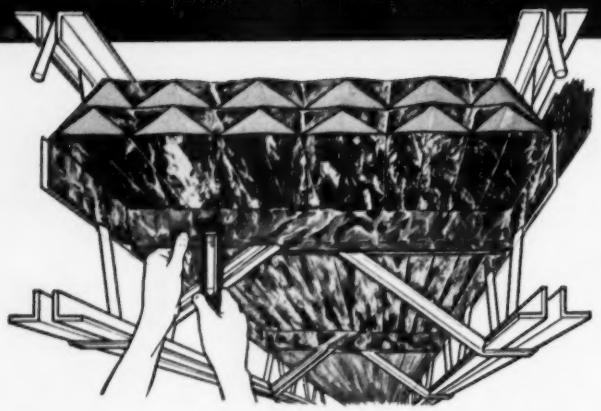
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

HP & AC

for Steel Beam and Truss Problems of Heat Loss, Heat Intrusion & Condensation



Costs 16¢ sq. ft., material with labor!

In Factories, Warehouses, Residences, Stores, Hospitals, Theatres, Markets, Arenas, Schools, Hangars, Gymnasiums

It is hard to keep these buildings warm in winter and cool in summer. Condensation sometimes forms, drips, causes damage. The problem is often solved by insulating with three tough, never-touching sheets of aluminum compartmented by two fiber partitions.

Steel beams are good conductors, extract much heat from the surrounding atmosphere, which causes a dew-point to be reached with resulting condensation. They need insulation against heat and vapor flow. Multiple accordion aluminum sheets are virtually non-condensation-forming, retain no moisture, have zero vapor permeability. Their heat emissivity on the cold side is 3%.

Contrast this with the necessity of heating-up tons of steel beams and ordinary insulation, sometimes wet, which wastefully radiate heat at a 90% rate on the cold side. In summer, iron and steel beams, ordinary insulations, and most building materials, often continue to radiate uncomfortable heat into a room long after the outside air has cooled.

Multiple accordion aluminum sheets are not only cooler at night, but through the hot summer day maintain temperatures which are sometimes 10 degrees to 20 degrees cooler than the shade outside.

A new form of pre-fabricated multiple accordion, very tough, aluminum insulation for steel beams and trusses is available as Infra 6HW, 1½" wider than standard, and heavier. A type 4HW, with 4 reflective spaces instead of 6, is also available.

The general question of preventing unwanted heat and vapor flow is authoritatively and interestingly discussed in Schwartz's "Simplified Physics of Vapor and Thermal Insulation." Steel and beam problems are included. For samples of the new insulation and copies of the manual, use the coupon.

Infra Insulation, Inc., 525 Broadway, New York, N. Y.
Telephone WOrth 4-2241

INFRA TYPE 6HW

Thermal Factors

Up-Heat	**C.089, R 11.23**	**=**	**4³/₈" dry rockwool**
Wall-Heat	**C.073, R 13.69**	**=**	**5⁵/₈" dry rockwool**
Down-Heat	**C.044, R 22.72**	**=**	**9" dry rockwool**

Exposed Aluminum .002" Thick
Bursting Strength 52 lbs. (Mullen Test)
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THE EDITOR'S PAGES

AS WE GO TO PRESS, the annual meeting of The American Society of Heating and Ventilating Engineers and the International Heating, Ventilating & Air Conditioning Exposition are being held in Chicago. These big events were "previewed" in the January HPAC, many of the meeting papers have been published in the ASHVE Journal Section (the others will follow in future months), and new products displayed at the Show will be described in our Equipment Developments columns.

AIR CONDITIONING ENTERS "GREATEST GROWTH PERIOD"

AIR CONDITIONING is entering upon "its period of greatest growth" and 1953 should prove to be the industry's biggest year to date by a substantial margin, according to Cloud Wampler, president of Carrier Corp.

"Total sales of the industry on a retail basis, which reached $1 billion in 1951, are estimated to be about $1¼ billion for 1952," he stated. "There is every indication that if present general business conditions continue this trend will be maintained and perhaps accelerated in 1953.

"While sales by the air conditioning industry during the new year should be at record levels, profits probably will not increase equally due to rising production costs, increased competition and lower profit margins on defense business," Mr. Wampler said.

"It now seems probable that the 1950's will be the great growth decade for our industry," he stated. Looking ahead 10 years, Mr. Wampler predicted that total sales to the public will reach the $5 billion mark by 1962.

Analyzing the major markets for air conditioning equipment, Mr. Wampler observed:

"In the past five years there has been a tremendous forward surge with respect to air conditioning of commercial buildings. This can be expected to continue, since almost no new, modern office building, hotel or apartment house of large size is being constructed without air conditioning. And in smaller commercial establishments also, the market is far from saturated.

"Use of air conditioning in production plants — which brought about the birth of the industry and provides its basic market — will continue to grow in importance beyond its tremendous expansion during recent war years.

"Room air conditioner sales, another major area of growth, amounted to about 400,000 units at retail for the industry in 1952, a gain of about 100 percent over the preceding year. For 1953, we anticipate a further increase in sales to more than 475,000 units. Carrier's production schedule for room air conditioners is double that of 1952 and this may be increased still further.

"Despite the great potentials in the foregoing fields of air conditioning, I believe that year-round home air conditioning presents the greatest single opportunity today for our industry," he said.

HOW LONG TO GET CONDITIONING EQUIPMENT?

IN THE COURSE OF preparing contracts for a large air conditioning installation in an existing building, the owner was startled to discover that it required 12 months to obtain a turbine drive for the proposed compressors, it was pointed out in a bulletin compiled in December by Syska & Hennessy, engineers, New York City.

Further investigation disclosed the following manufacturing periods required for various items of equipment:

Centrifugal compressors — 5 months.

Electric motor drive, starters and gears — 16 weeks.

Turbines — 12 months.

Steam condensers — 16 to 20 weeks.

Reciprocating compressors, evaporative condensers, fan coil air conditioning units — 4 to 6 weeks.

Coils — 4 to 6 weeks.

Absorption refrigeration machines — 5 months.

Unit air conditioners — 13 to 17 weeks.

The demand for all types of air conditioning equipment substantially exceeded the available supply last summer, according to Syska & Hennessy, who also report that information obtained from manufacturers indicates that they are providing for a 25 percent increase in the available equipment over that which was available last spring. If the demand exceeds this total amount, of course the equipment delivery dates indicated above would again be longer.

PIPING PROMISING MARKET FOR PLASTICS

PIPING IS A promising new market for a variety of plastics, used either as coatings for other pipe, or as pipe itself, the Industrial Bulletin of Arthur D. Little, Inc., points out. Plastic piping has found many applications where corrosion resistance, flexibility, or light weight are desired. While substitutes for metal pipe and fittings are not new, their use has increased tremendously since World War II, and development of new types in standard sizes indicates that increasing use will be made of plastics. Plastic pipe consumed about 5 million pounds of resin in 1951, but manufacturers predict that in another 10 years production of such piping will reach 75 million pounds per year. This still will be only a small portion of the total piping used, however.

AIR CONDITIONING LEADS IN BUILDING MODERNIZATION

MODERNIZATION expenditures and plans reported by 195 building owners and managers as of December 6 to the National Association of Building Owners and Managers — and published in the association's journal, Skyscraper Management — totalled $1,589,100 for air conditioning in progress during 1952 and $5,112,700 planned for 1953. Only elevators exceeded slightly the "in progress" figure for air conditioning, and the "planned 1953" figure for air conditioning exceeds substantially any other of the classifications (which comprise elevators, lighting and electrical, heating equipment, plumbing and toilets, acoustical, interior, and exterior.)

For heating equipment, the "in progress 1952" figure is $99,567 and the "planned 1953" figure is $743,100.

The report was based on a nationwide sampling for presentation to the association's board of governors.

REFRIGERATION MEN MEET, EXHIBIT

MIAMI WAS A CENTER of interest for the refrigeration and air conditioning industry in December, with the 10th refrigeration and air conditioning educational exhibit and conference jointly sponsored by the Refrigeration Equipment Manufacturers Association and the Refrigeration Service Engineers Society. The Refrigeration and Air Conditioning Contractors Association and the Refrigeration Equipment Wholesalers Association also cooperated, and attendance was 1736.

Seventy-one manufacturers furnished educational displays, held in the Miami municipal auditorium. The Alco Valve display was judged "the most educational exhibit."

At the 15th annual meeting of the Refrigeration Service Engineers Society, Carl W. Neisel, Corpus Christi, Texas, was re-elected president.

At the 7th annual meeting of the Refrigeration and Air Conditioning Contractors Association, George T. Howe, of Chicago, was elected president and Edna Berggren, Chicago, executive secretary.

Ben Blazer, M. Blazer & Sons, Passaic, N. J., was elected president of the Refrigeration Equipment Wholesalers Association.

Next and last in the series of educational exhibits and conferences will be held at Seattle, April 24-26, 1953.

RETAIL MODERNIZATION OFFERS BIG MARKET

HEATING, AIR CONDITIONING and refrigeration manufacturers will share substantially in "the $6 billion market for new and modernized stores during 1953," according to the Store Modernization Institute, which predicts a record year for such expansion.

'53 INDUSTRIAL CONSTRUCTION "TO BE STABLE"

THE PROSPECT OF intensified competition in most fields of production is likely to maintain a steady demand for industrial engineering and construction services throughout 1953, according to William Collins, president of Walter Kidde Constructors, Inc., engineers and builders.

He said that the completion of many post-Korean defense plants will probably result in a period of temporary readjustment among companies specializing in the design and construction of industrial facilities, but that the long-term outlook for this segment of the building industry seems good.

"Manufacturers in almost all fields are actively seeking methods to reduce costs," he explained. "In many industries, the process has become so closely integrated with the building structure that major layout changes required to effect economies often call for considerable construction. In some cases, manufacturers find it more expedient to build entirely new plants than to revamp existing facilities."

ASK ORDINANCE ON BATH HOUSE TEMPERATURE

AN ORDINANCE ON maximum heat in, and close supervision of, public bath houses has been recommended to Chicago's city council by the board of health. It calls for a maximum bath temperature of 110 deg.

Last year, two persons died in an overheated bath house, according to Dr. Herman N. Bundesen, president of the board of health.

ALASKAN BUYS AIR CONDITIONED CAR

THE OLD GAG ABOUT the super-salesman who could sell a refrigerator to an Eskimo is way out-of-date. According to J. F. Wolfram, of Oldsmobile, they've sold an air conditioned automobile in Alaska. A check on the order showed that the buyer wanted filtered air to keep out deer flies and other insects, the cooling feature being somewhat incidental.

Another unusual order came from Boston. The buyer is a worm dealer who delivers by passenger cars and summer heat has been the cause of excessive death of his product.

RIGHT HOSPITAL TEMPERATURES AID RECOVERY

THE TEMPERATURE OF hospital rooms can be as important to the patient's recovery as it is to his comfort, delegates to the American Hospital Association's 54th annual convention in Philadelphia were told recently.

Dr. Darell Boyd Harmon pointed out that scientifically proper room temperatures can strongly support normal therapeutic procedures in a patient's recovery. Speaking at a special luncheon meeting sponsored by Minneapolis-Honeywell, Dr. Harmon said that "comfort is only one of many temperature factors affecting the patient's well-being."

Holds 125,000 Gallons of Ice Cream

FIVE-FOOT AIR DIFFUSERS mounted on the ceiling of the hardening room in the new Sealtest ice cream plant, Pittsburgh, give an unusual effect in this photo. The hardening room, 90 by 140 ft in size, is the largest area in the new plant and will hold 125,000 gal of ice cream — one week's production at peak demand in summer. Temperature in the room will be held at a constant 20 deg below zero, maintained by the current of refrigerated air pouring from the room's 96 big diffusers. Air in the room will change almost three times per minute when the room is empty, and oftener as it becomes fuller

TRU-PERIMETER HEAT

at a Country Club

Forced hot water with Webster Walvector, some under floor, Webster Baseboard and Webster CF-2 Continuous Flow Control meets unusual architectural requirements.

When Architect William Henley Deitrick set out to design the new Carolina Country Club his aim was to provide complete flexibility to meet the requirements of approximately 600 members. In accomplishing his objective he provided for a terrace on three sides and for full length windows over practically the entire northern exposure.

The resulting challenge to the heating engineer was fully met by Webster Forced Hot Water Tru-Perimeter Heating. Webster Walvector, installed under grilles the full length of the glass-enclosed side, provides complete winter comfort (see detail at right). Standard Walvector serves the Manager's office and kitchen. Other spaces and second floor lounges and toilets have Webster Baseboard. The separate locker building is supplied with a Webster Series R Unit Heater.

Are you planning a club or other difficult-to-heat building? Investigate Webster Tru-Perimeter Forced Hot Water Heating. For details write us or see your Webster representative. Dept. HP-2

WARREN WEBSTER & COMPANY
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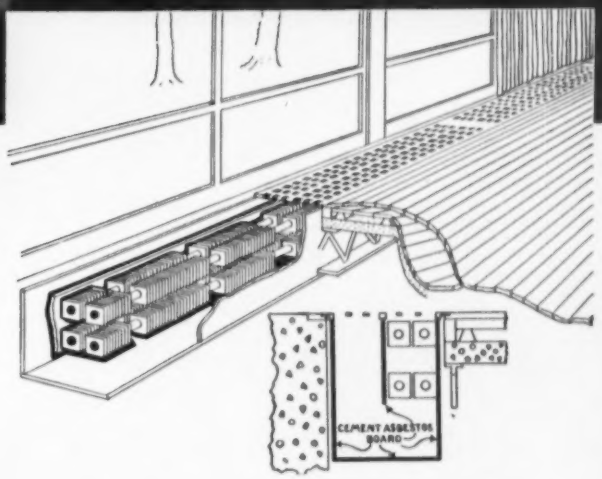
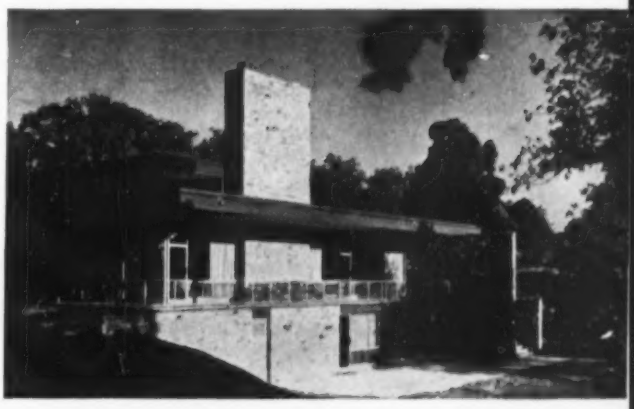
Webster WALVECTOR
REG. U. S. PAT. OFF.
For Steam or Hot Water Heating

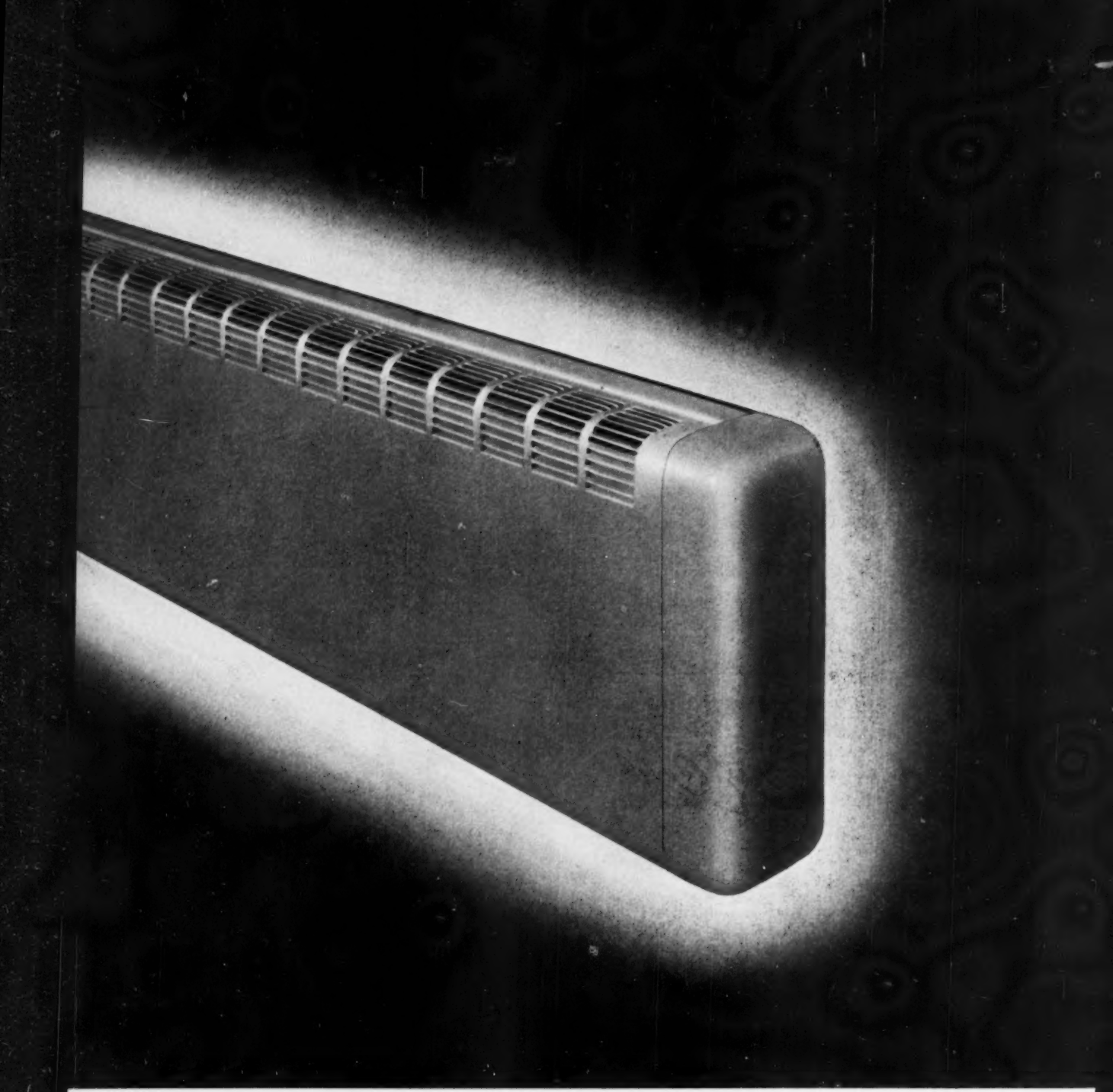


Sketch shows arrangement of Walvector below floor. Upper view shows lounge with sliding doors and grilles over Walvector.

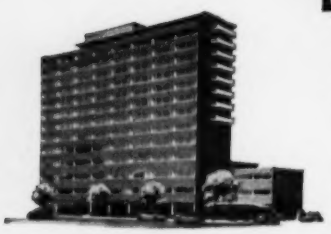
Wm. Henley Deitrick, Inc., Architect; Ray V. Wasdell, Structural Engineer; H. W. Moser, Mechanical Designer; Matthew and Stanislawa Nowicki, Interior Decoration; E. G. Thurlow, Landscape Architect; Strong & Harmon, General Contractor; Smith & Mills Plumbing & Heating Co., Heating Contractor.



Carolina Country Club, Raleigh, N. C.



DESIGNED FOR MODERN HEATING



Nesbitt Sill-line offers you all the benefits of high-capacity wall-fin radiation in the first enclosure expressly styled to harmonize with contemporary building design. Here's quick, uniform, under-the-window perimeter heating that provides economy of operation, ease of installation, and wide flexibility; *plus* an entirely new concept of enclosure styling so desirable for today's institutional and commercial buildings. If you desire further information on this new product, send for Nesbitt Publication 271.

Sill-line will heat the New Pavilion, Jefferson Hospital, Philadelphia, Pa.
Vincent G. Kling, Architect
A. E. D'Ambly, Engineer
W. M. Anderson Co., Htg. Contractor

NESBITT **SILL-LINE RADIATION**

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"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

OPERATING BIG REFRIGERATION, AIR CONDITIONING SYSTEM

A 4000 TON refrigeration plant — including unit sizes from ½ ton to 800 tons — is large in terms of numbers of individual equipment and in terms of total tonnage is much larger than most installations. Although the 4000 tons is not qualified in Charles E. Mandley's article on operating an air conditioning installation (in the January HPAC), it is assumed this is actual output at design temperature rather than the standard ASRE rated tonnage.

It would be interesting to learn the calcium chloride brine temperature, specific gravity used, and whether the brine pH is controlled in the system which is used for the aeroballistic research area. Our experience with two 9 F and two —36 F calcium chloride brine systems has shown the justification of using sodium bichromate as an inhibitor against corrosion and to control the pH at 7.5 to 8.0. Prior to using the sodium bichromate about 13 years ago, on one system the pH was 9.4 and we were experiencing difficulties with plugged cooling coils, corrosion of soldered joints in the return bends of copper coils, and stoppages in low points in small distribution piping with intermittent or low flow. Material removed from plugged coils analyzed about 75 percent iron oxide, with the remainder calcium carbonate, zinc and aluminum oxide plus some organic material.

Calcium chloride brine is a strong electrolyte solution possessing a high corrosion potential which may be increased by contact with air or refrigerant leakage (especially carbon dioxide or ammonia) into the brine system. The brine should be maintained at a very slight alkalinity to give the least corrosion troubles with zinc or iron. More alkalinity causes pitting, while an acid brine would cause a rapid overall corrosion. About 100 lb of sodium bichromate is required per 1000 cu ft of brine. If the resulting pH becomes too low due to the chromate, caustic soda can be added to raise the pH. Since the treating of our brine systems, no further trouble has been experienced.

Low Temperature Refrigeration

The use of "Freon 22" in a low temperature system is not too common. Operating experience with this refrigerant would be of interest if and when such data is available. I have had no direct experience with this refrigerant, but I understand it is not commonly used — partly because it is not miscible with lubricating oils at evaporator pressures. This situation would cause oil to float on top of the refrigerant, restricting evaporation, and probably would be difficult to return to the compressors.

The "Freon 22" system described by Mr. Mandley uses three reciprocating compressors staged in series on a direct expansion low side. Oil loss and return is always much more of a problem with reciprocating compressors than with centrifugal compressors and in this case with "Freon 22" would seem to present a greater problem. I think Mr. Mandley could have increased the value of his article at this point if he had presented more detail, with perhaps some operating experience.

A second system mentioned uses "Freon 12" with both centrifugal and reciprocating compressors in series. The "indirect refrigerant" is methylene chloride. By this I assume the system is using methylene chloride as the circulated brine. With no operating brine temperature mentioned, one can only assume that this is another low temperature system, otherwise some other less expensive brine could be used. If this is the case, there are several pitfalls to watch out for in using methylene chloride at low temperature. It would be interesting to learn how Mr. Mandley handled them and what his operating experience has been.

Commercial methylene chloride received in tank car lots contains about 0.014 percent moisture by weight. The equilibrium or saturation temperature of methylene chloride containing this amount of moisture is about —35 F. At temperatures below this, excess moisture will freeze out of solution and deposit on the evaporator tubes. This situation would reduce the system capacity appreciably, due to the restriction in heat transfer. Defrosting of the evaporator at frequent intervals would be required and the brine system dried until the moisture content was reduced to a point below saturation at the operating temperature.

The nitrogen gas used to maintain the system pressure should be dry to prevent added moisture entering the methylene chloride. Commercial nitrogen as ordinarily used would require dehydrating before it is introduced into the system. Ordinary compressed air, if properly cleaned and dried, can be used successfully to maintain system pressure. For instance, on a methylene chloride brine system designed for —100 F operation, compressed air at 35 psig with a dew point of about —70 F is used to maintain the system pressure. This system has been successful for 4½ years.

Maintenance Training Program

The training program for maintenance mechanics and operators outlined by Mr. Mandley is excellent and appears to go beyond the average training program in most industries. I am sure the Naval Ordnance Laboratory program is well justified and will pay dividends in the long run by reducing repair and operating costs of an undoubtedly very complicated system.

I would gather from Mr. Mandley's description of the maintenance program that some of the operators do maintenance work during low load periods. Such an arrangement is possible when seasonal load variations allow the relief of operators for other work. In industries where refrigeration systems are used for process and the loads are affected but

little by weather, a separate maintenance crew is required. The NOL plan would seem to have the advantage that the operators would have an intimate knowledge of operating defects to be corrected.

Preventive maintenance as outlined in Mr. Mandley's article is a very necessary program; however, it should be made flexible enough so that individual items can be altered based on past experience. The NOL program includes performance checks of compressors, pumps and other elements. These checks are very necessary if the program is to remain in the preventive category and not revert to an "inquisitive" maintenance program whereby a piece of equipment is opened up merely because the calendar says it is time to do so.

Clean Air for Controls

In regard to pneumatic controls, the use of clean and dry compressed air is very important in reducing automatic control device maintenance. Oil filters and dessicant air dryers can do a good job of providing this air. Oil removal is very essential to prevent the clogging of the small orifices in controllers. In the case of an important controller, a misplaced drop of oil could shut down or disrupt the operation of critical equipment with resultant process losses.

The overall NOL maintenance program, together with the important training program, appear to be excellent, with provision to take care of any contingency.

Although housekeeping in the plant is not mentioned as such, it can be taken for granted that this plant must be very clean and well painted. Such an environment always encourages good maintenance and high employee morale. A well maintained and operated plant is a safe plant and NOL's apparent safety record is the proof.

Mr. Mandley is to be complimented for the fine organization and operation of an extensive and complicated refrigeration plant. He description of his organization and equipment, with the exception of a few operating details mentioned above, is very informative and could be used as a pattern for other similar installations to follow.—J. H. SHAW, Eastman Kodak Co.

GAS FOR AIR CONDITIONING HELPS UTILITY'S LOAD

GEORGE L. WIGGLESWORTH, JR., aptly points out — in his article in the November HPAC — two facts which might be enlarged upon to help the reader interpret the problems associated with unbalanced utility load factors, as well as an approach to their solution.

The statements appear in the article that "use of gas for summer cooling more than balances out the winter heating load" [this is true in the southern part of the country but would not hold north of St. Louis], and "it appears that if space heating is added without a balancing load (such as air conditioning), peak shaving is here to stay".

Since the hourly demand for gas used in a gas air conditioning system for cooling a structure is invariably less than the demand imposed by that same structure for winter heating (except in the extreme southern parts of the United States), it follows that distribution facilities which are capable of handling the heating load of a utility's customers are also adequate for handling the cooling load of those same customers without additional capital investment by the utility.

Air conditioning is considered a high-grade usage of gas fuel and thus permits sale of gas at a rate which is profitable to the utility as against an interruptable industrial rate which, in many cases, is not profitable to the utility. Rates for gas sold for cooling purposes are usually the same as those which apply to gas used for space heating.

In recent years, the growth in public acceptance for summer comfort cooling in commercial spaces, industrial plants and residences has opened enormous opportunities for profitable disposition of surplus summer gas by utilities who have the problem outlined in Mr. Wigglesworth's article.

It would, therefore, seem that gas utilities generally should investigate air conditioning markets as a means immediately available to them of helping overcome these extreme load variations.—JOHN A. GILBREATH, Assistant Vice President, Air Conditioning Div., Servel, Inc.

REPLY BY AUTHOR — The addition of air conditioning load as suggested by Mr. Gilbreath is, I believe, one of the greatest desires of the gas utility engineers. It provides a good rate with diversified customers and balances the seasonal valley, providing much better distribution system pipe line load factors.

Although air conditioning is one answer, our case also involved an element of time. In signing a demand commodity contract, a problem of controlling large volumes of gas had to be solved in somewhat of a hurry. We turned to the industrials until the air conditioning load could be further developed. Considering the high temperature in summer and the low temperature in winter, it is conceivable that the summer cooling load could reach the same proportions as the winter space heating load. However, summer cooling has not yet approached these limitations in our company. In such a case the industrial customer would again be called to fill the spring and fall valley. Industrial load is desirable, although air conditioning holds its own very respectable position.—GEORGE L. WIGGLESWORTH, JR.

AIR QUANTITY FOR COOLING BUSSES

IN THE REPORT on automobile air conditioning in the January HPAC, the air quantity required for cooling a typical 41 passenger bus should have been given as 1650 cfm instead of 600 cfm. The 1200 cfm as given in January for heating is correct.

Problems in bus air conditioning involve — according to H. Schjolin, New Development Engineering, GMC Truck & Coach Div., General Motors Corp. — the following:

1) Reduced weight and cost.
2) More troublefree operation.
3 Abandoning the separate engine driving the compressor, although the flexibility of a separate drive is desirable.

In connection with the Oldsmobile air conditioning system, the two air scoops pick up a total of 60 cfm at 50 mph, rather than "60 cfm each."

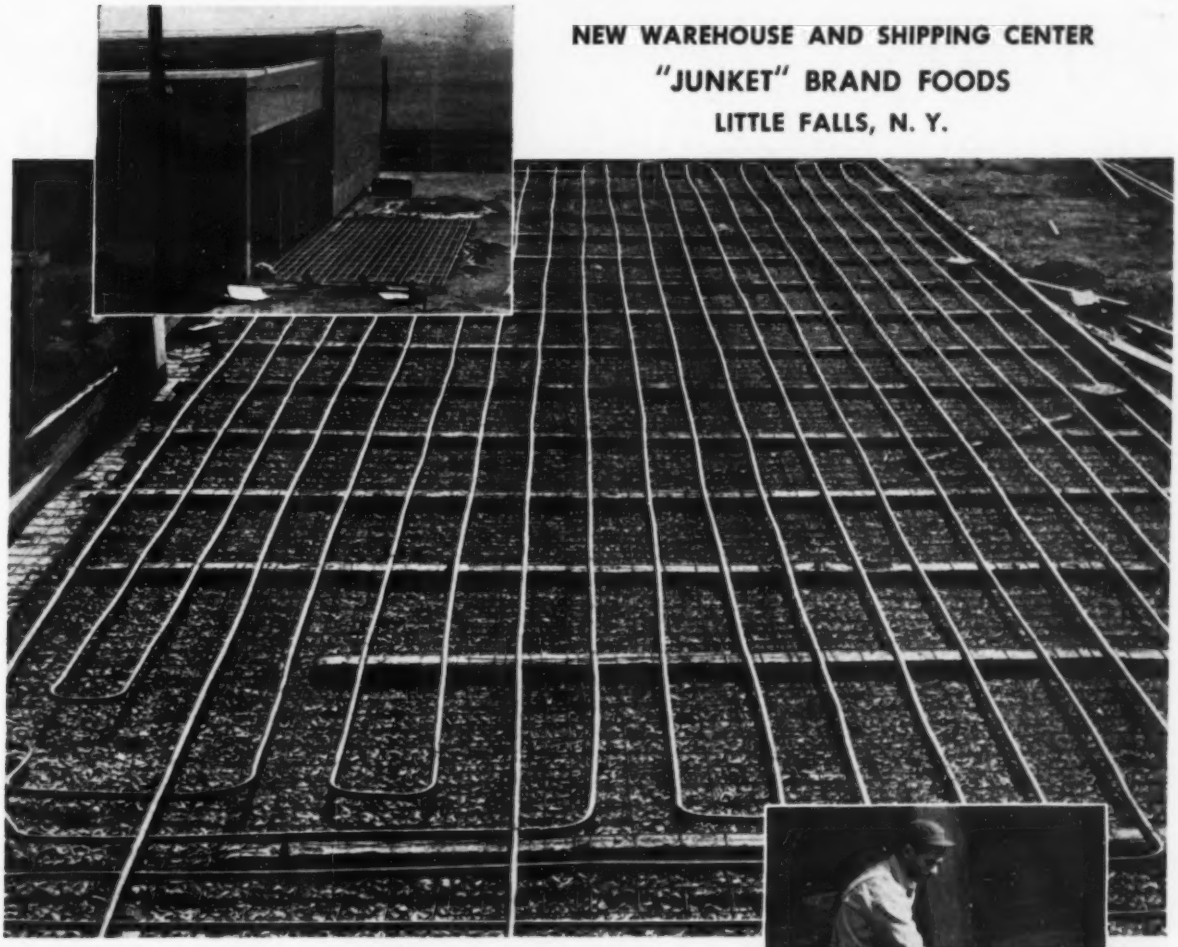
"QUOTE"

"Polluted air is exacting a heavy toll in sickness and death, a toll of such magnitude as perhaps to constitute one of today's (and tomorrow's) major public health problems."—DR. CLARENCE A. MILLS, in a recent paper in the Bulletin of the American Meteorological Society.

NEW WAREHOUSE AND SHIPPING CENTER

"JUNKET" BRAND FOODS

LITTLE FALLS, N. Y.



ANOTHER CASE OF *Copper* WHERE IT COUNTS!

During the winter months there will be no snow or ice troubles at the truck entrance of the new "Junket" Brand Foods Warehouse. A snow-melting system of Revere Copper Water Tube in the 20′ x 60′ concrete slab sees to that. This building was designed by Architects, Bagg and Newkirk. Heating Contractor was H. J. Brandeles Corp. Revere Copper Water Tube was supplied by the Crane Co., all of Utica, N. Y.

The contractor found the light-weight, 60′ length coils of Revere Copper Water Tube easy to handle and install. Also, its soft temper permitted bending, reducing the number of fittings used. Other features that architects, contractors and builders like about Revere Copper Water Tube are: Because it is non-rusting it will last indefinitely . . . the solder or compression fittings used make it possible to use a thinner wall tube than is possible when threaded fittings are used, with a substantial saving in metal.

Now, with restrictions eased, and quantities permissible without allotments greatly increased, there isn't any reason why your next job can't have the many lasting benefits of Revere Copper Water Tube for hot and cold water lines, radiant panel heating, underground service lines, processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

GUIDE PLANK is used by workman to facilitate installation of 1" Type K soft temper Revere Copper Water Tube. Revere Tube also comes in hard and soft tempers in straight lengths of 20 ft.

LARGE PHOTO ABOVE shows Revere Copper Water Tube in place ready for pouring concrete.

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COPPER AND BRASS INCORPORATED

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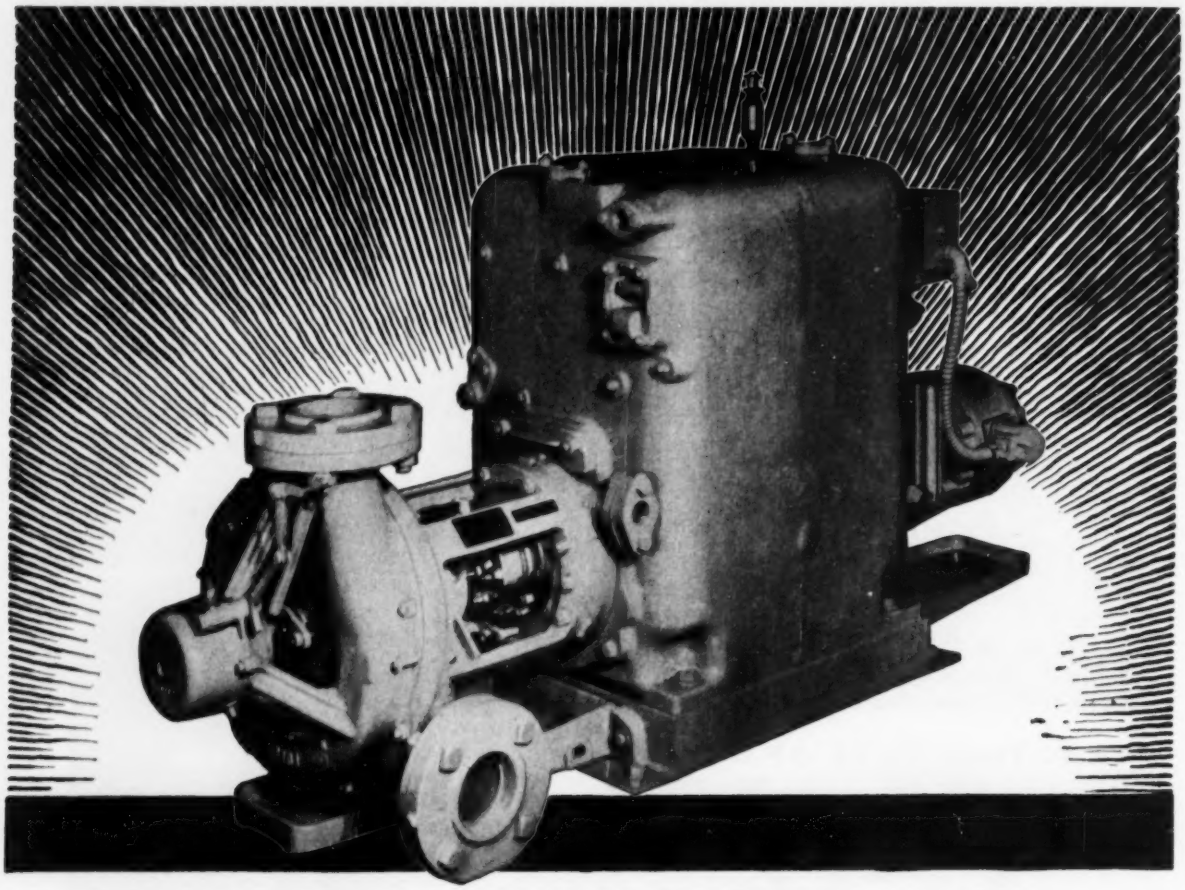
Safety!

THE NASH VAPOR TURBINE HEATING PUMP IS NOT STOPPED BY ELECTRIC CURRENT FAILURE



For service in greenhouses, hospitals, schools, theatres, and public buildings, where heat failure is a serious matter, the Nash Vapor Turbine Return Line Vacuum Heating pump should be specified, for this pump operates perfectly without electric current.

This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the Vapor Turbine is returned to the system for heating, with little heat loss.

This pump insures constant heat in the system, it eliminates electric current cost, and it promotes high efficiency in the heating system. Heating efficiency is due to the fact that this pump can operate continuously with economy. Continuous operation means uniform circulation, and uniform conditions in the system mean steam saving.

This pump has but one moving part, no internal wearing parts, and requires no internal lubrication. Bulletin D-246 tells all about it, and it is free on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Dehumidified Pipe Galleries

The world's largest water filtration plant is also the driest. Dehumidifying equipment has eliminated the usual rain-like atmosphere in pump room and filter galleries and has checked equipment corrosion, rotting of electrical wire and peeling paint and has decidedly improved working conditions. Reduced painting requirements alone will amortize the dehumidifying equipment in only five years.

By W. W. DeBerard

City Engineer
Chicago Bureau of Engineering

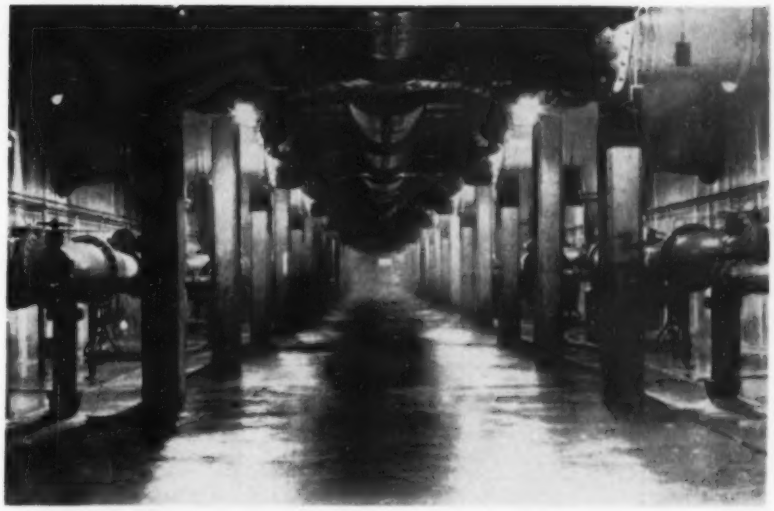


FIG. 1—FILTER PIPE GALLERY at Chicago's south district filtration plant prior to installation of dehumidification equipment

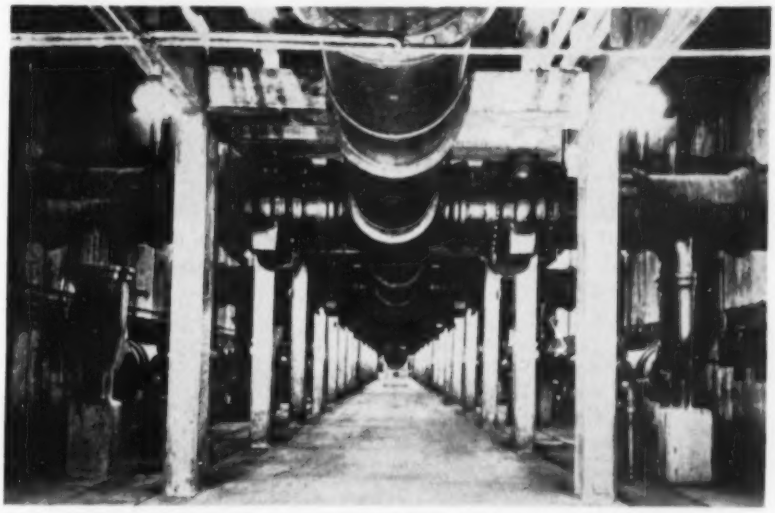


FIG. 2—SAME VIEW as Fig. 1, after dehumidifiers were placed in operation. Not only has this dry atmosphere improved working conditions, but has also decidedly reduced equipment corrosion and failures caused by moisture

FIG. 1 IS A PHOTO of one of Chicago's south district filtration plant pipe galleries, taken May 1950. The wet, damp, misty atmospheric condition illustrated existed daily the year 'round. Everything in the gallery, from the floor to the ceiling, was covered with moisture, and a light mist hung in the air. The relative humidity remained constant at 98 percent. A layer of condensate covered all walls, the floor, the ceiling, all pipes, and the filter rate control equipment.

Corrosion of this rather delicate rate control equipment was becoming a serious problem. Paint readily lifted off metal surfaces. No maintenance work could be performed for more than a short period of time in the cold, damp, atmosphere.

What Pipe Gallery Dehumidification Does

Fig. 2 is the same view of the same pipe gallery, taken subsequent to September 1950. It was during this month that dehumidification equipment was installed at the south district filtration plant to provide dry filter pipe galleries.

The result is self-evident. This new, dry atmosphere has checked corrosion of piping and equipment, reduced equipment failure, cut maintenance time and expense considerably, and generally improved working conditions. So far as is known, this is the first pipe gallery dehumidification installation in the world.

The problem was one of removing moisture from the air in sufficient volume — that is, to lower the air dew point — to prevent moisture condensation on cool surfaces, such as the concrete walls, the piping, valves, controllers, etc. The pipe galleries are particularly susceptible to this condensation problem, primarily due to their elevation of 14 ft below the surface level of Lake Michigan.

On all sides of each of the four galleries are walls for the filter beds, the settled water header, and the clear wells. In addition, a settled water lateral runs along the ceiling of each

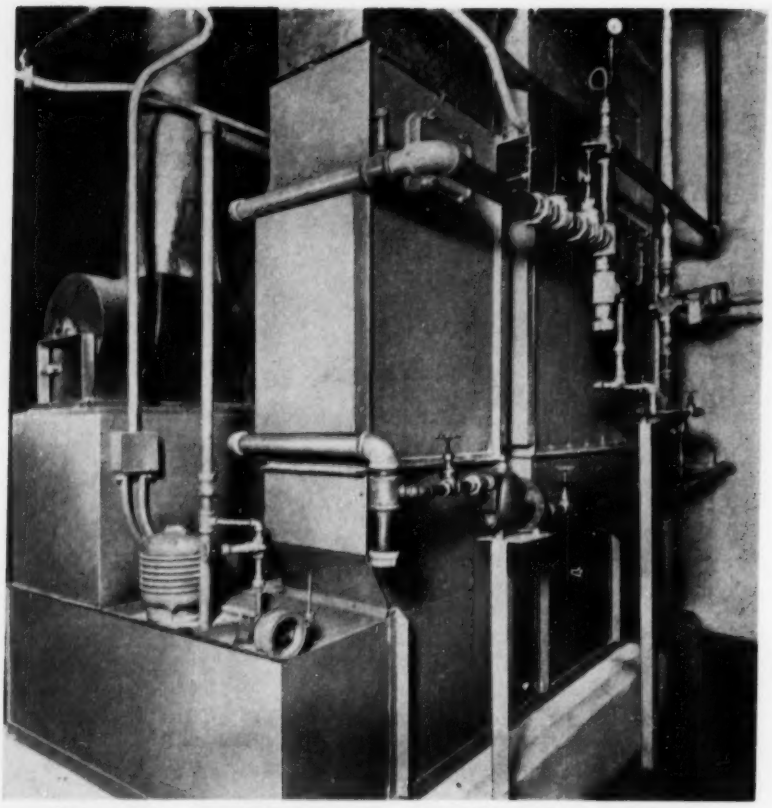


FIG. 3—THE 5000 CFM air capacity dehumidifier serving the wash water pump room. Air washer chamber is in background, regenerator chamber in foreground.

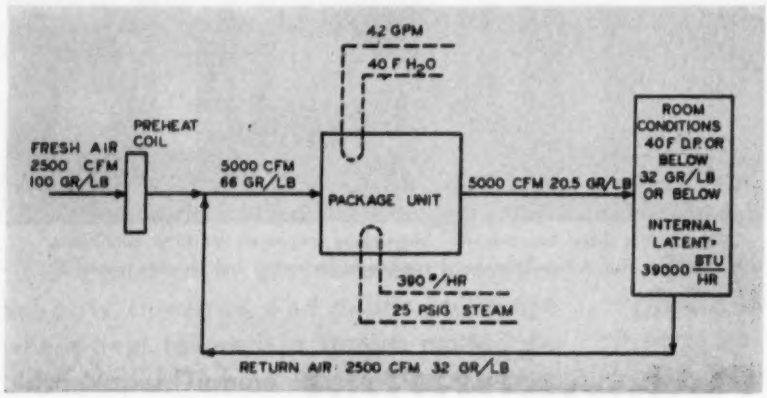

42 GPM
40 F H_2O
PREHEAT COIL
FRESH AIR 2500 CFM 100 GR/LB
5000 CFM 66 GR/LB
PACKAGE UNIT
5000 CFM 20.5 GR/LB
ROOM CONDITIONS 40 F D.P. OR BELOW 32 GR/LB OR BELOW
INTERNAL LATENT 39000 BTU/HR
380 #/HR
25 PSIG STEAM
RETURN AIR 2500 CFM 32 GR/LB

FIG. 4—SCHEMATIC AIR FLOW diagram of dehumidifying system operating for wash water pump room under worst possible air conditions (50 percent fresh make-up air). In this illustration, moisture removed from total air is approximately 420 gal per day

gallery. Hence, each gallery is almost completely surrounded by water. Below the galleries is the spacious, open under-area, also containing water; but, since no actual body of water contacts the underside of the gallery floor, this adjacent space does not affect to any great extent the moisture problem under consideration.

Cold Surfaces, Humid Air Create the Problem

The water which passes on the outside of the walls for each of the galleries, and that flowing within the gallery pipes, is almost always cooler than the air dew point temperature in the galleries under normal, non-dehumidified air conditions. When this warmer — and, usually, humid — air in the galleries contacts the colder surfaces present, the air is cooled to within a degree or two of these surfaces, the latter at a temperature practically identical to that of the water. As the air cools, its capacity to retain moisture decreases. If, at any time, this air is cooled below its dew point temperature, it will deposit moisture on the cold surfaces, causing wet walls and pipes.

Prior to installation of dehumidification equipment, the air temperature in the filter galleries ranged from 70 F during the summer months to 35 F in the winter. At 70 F, 1 lb of dry air holds a maximum of 110 grains of moisture. At 35 F, 1 lb of dry air can hold only 30 grains of moisture. If, for example, 70 F air saturated with moisture touches a surface whose temperature is 35 F, the air will give up 80 grains of moisture for every pound of air cooled to 35 F. However, if 81 grains of moisture is removed from each pound of air before this air is circulated in the filter galleries, the problem of moisture condensation is eliminated.

Chemical Dehumidifiers Dry Pipe Gallery Air

Installation of chemical absorbent-type dehumidification equipment operating upon this principle has successfully solved the filter pipe galleries condensation problem at the south district filtration plant. In actual practice, the air circulated in the galleries is dehumidified to 32 grains per lb to care for the additional moisture load due to water infiltration through the retaining walls, from leaks in pipe joints, etc.

Moisture removal from air may be accomplished (1) by lowering the temperature of the air, or (2) through the use of sorbents. For the first method, the air to be dehumidified is passed over cooling coils or cooled in an air washer to a dew point temperature lower than the temperature of the cold surfaces in question. For a filtration plant, lake water could not be used in the cooling coils or as the spray in an air washer, since this practice would result in saturated air dew point temperatures approaching the temperature of the cold surfaces in contact with this same lake water.

For the second method — that

utilizing sorbents — the air is brought in contact with sorbents (substances which have the property of extracting and holding water vapor from the air). The substances used for this purpose have a capacity for retaining moisture which is very large when compared to their volume and weight. Since, with the sorbent method, it is not necessary to cool the air to the freezing point or below in order to obtain subfreezing dew points, the icing problem is not encountered. In addition, the moisture-retaining capacity of liquid chemical absorbents becomes greater as their temperatures decrease, thereby compensating for a lower temperature operation.

This second method, using a lithium chloride base solution absorbent, is the one employed at the south district filtration plant. This humidity conditioning equipment consists essentially of an air washer and a separate solution regenerator. Air passed through the washer is dehydrated a specified amount upon contact with the absorbent, and the latter is automatically restored to its original moisture absorbing strength in the regenerator. Ducts, circulating fans, and diffusers distribute the dry air throughout the area served.

Pump Room Pilot Installation

Use of this equipment in the filter galleries was preceded by a pilot installation in the wash water pump room. Results from this initial installation, which was put in operation in 1948, were so satisfactory that plans to dehumidify the filter galleries were carried out.

In the pump room, a 5000 cfm air capacity humidity conditioning unit, incorporating both the air washer and regenerator components on one base (Fig. 3), supplies dry air through an external exhaust fan to a 210 ft galvanized duct suspended from the length of the room ceiling. Four diffusers distribute the air uniformly to the 234,000 cu ft space. An air change occurs every 37 minutes when no outside make-up air is introduced into the system.

Make-up fresh air, which is used to limit moisture infiltration and penetration through the walls, can be introduced into the system through suitable damper arrangements. For this purpose, and also to avoid a

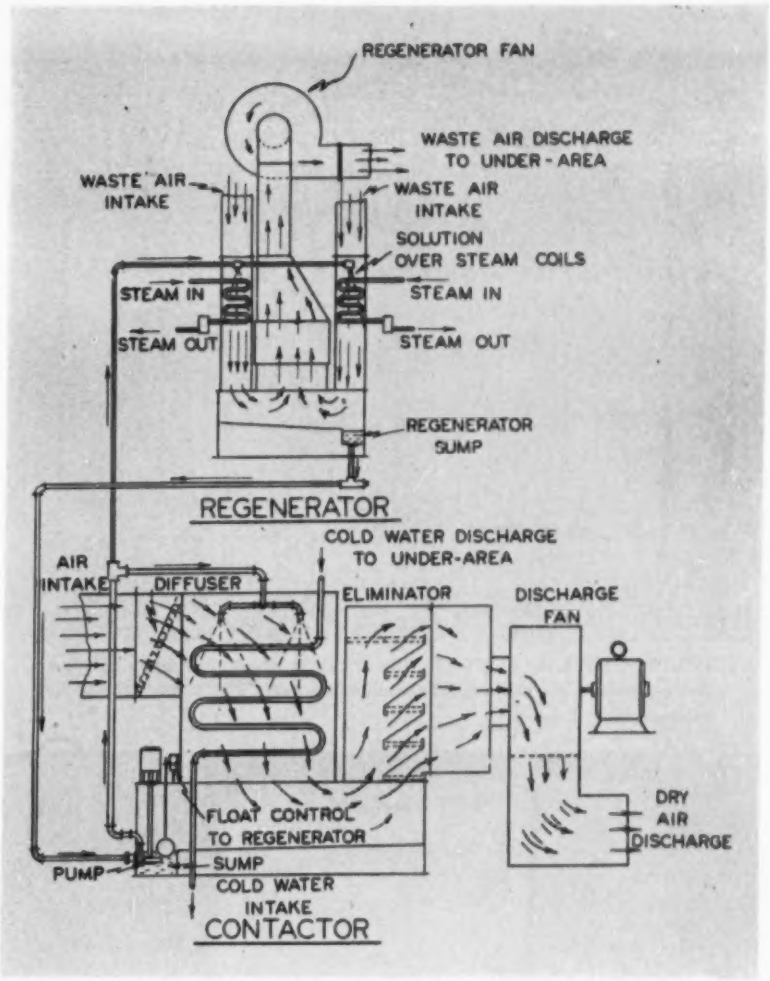


FIG. 5—SCHEMATIC DRAWING of dehumidifying unit operation. Air to be dried makes contact with the absorbing solution; both air and absorbent pass over cooling coils in air washer (contactor). Cooling coils, by controlling absorbent temperature, enable control over amount of air drying accomplished

TABLE 1—DEHUMIDIFYING EQUIPMENT OPERATING DATA at Chicago's south district filtration plant. One integrated unit is installed for the wash water pump room; two units, composed of a separate air washer and absorbent regenerator each, are required for the filter galleries

Item	Wash water pump room	Filter galleries
Humidity conditioning unit air capacity (max. cfm)	5000	35,000
Fresh make-up air (max. cfm)	2500	3,500
Steam (max. lb/hr)	390	1,280
Cooling water (max. gpm)	42	174
Motors, hp	2 — ¾	4 — 2
	1 — 5	2 — 3
		2 — 10

TABLE 2—APPROXIMATE OPERATING COSTS for dehumidifying equipment for the filter galleries at Chicago south district filtration plant. Compressed air cost is nil. Maintenance cost savings, due to dehumidified atmosphere, attributed to filter gallery equipment dwarf operating costs

Utility	Unit rate	Daily cost
Steam: 1000 lb/hr (average)	$0.0005/lb	$12.00
Cooling Water: 210,000 gal/day (average)	$12.50/mg	2.62
Electricity: 537 kwh/day (average)	$0.008/kwh	4.30
Total cost:		$18.92
Cost of yearly operation:		$6900.00

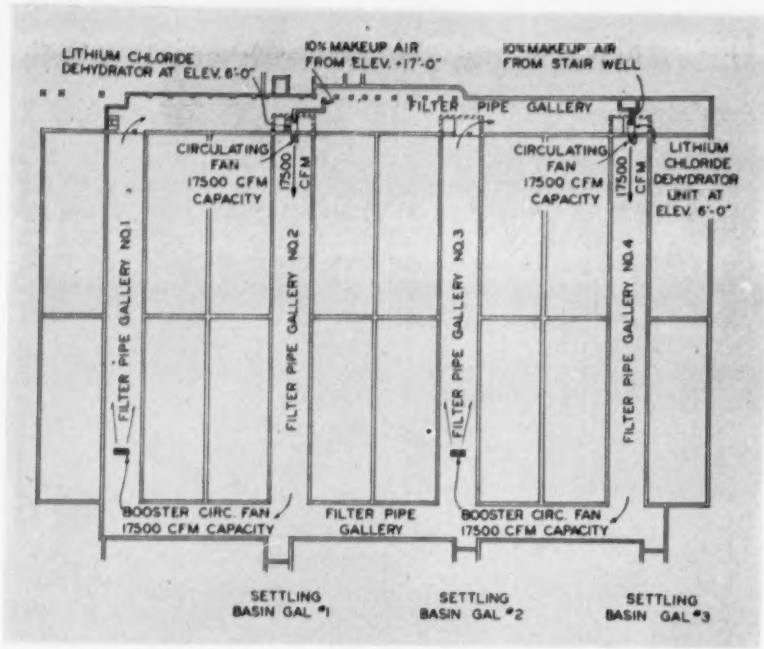

LITHIUM CHLORIDE DEHYDRATOR AT ELEV. 6'-0"
10% MAKEUP AIR FROM ELEV. +17'-0"
10% MAKEUP AIR FROM STAIR WELL
FILTER PIPE GALLERY
CIRCULATING FAN 17500 CFM CAPACITY
17500 CFM
CIRCULATING FAN 17500 CFM CAPACITY
17500 CFM
LITHIUM CHLORIDE DEHYDRATOR UNIT AT ELEV. 6'-0"
FILTER PIPE GALLERY NO.1
FILTER PIPE GALLERY NO.2
FILTER PIPE GALLERY NO.3
FILTER PIPE GALLERY NO.4
BOOSTER CIRC. FAN 17500 CFM CAPACITY
FILTER PIPE GALLERY
BOOSTER CIRC. FAN 17500 CFM CAPACITY
SETTLING BASIN GAL #1
SETTLING BASIN GAL #2
SETTLING BASIN GAL #3

FIG. 6—GENERAL PLAN of filter building, showing natural air flow ducts provided by galleries. Dehumidifying units are located at top of galleries Nos. 2 and 4

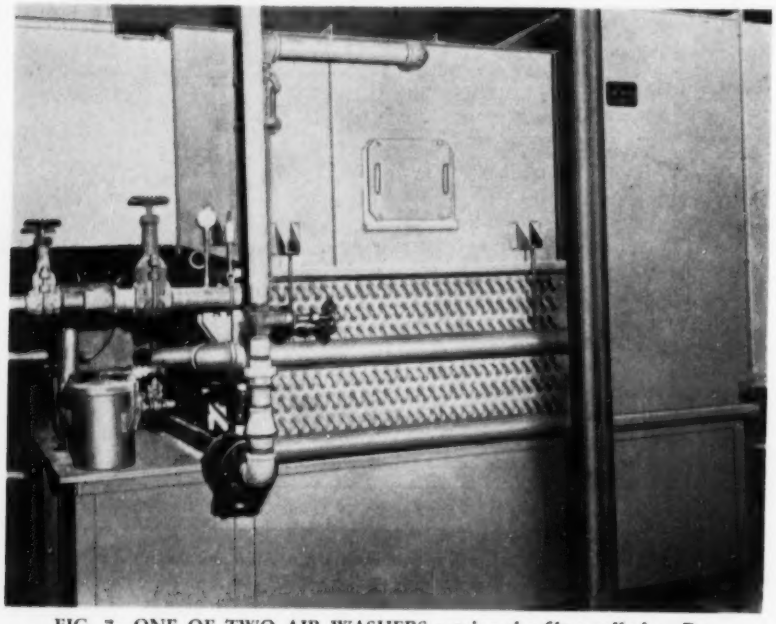


FIG. 7—ONE OF TWO AIR WASHERS serving the filter galleries. Protruding cooling coil return bends are seen in center of equipment, with inspection door directly above to facilitate inspection of flooding nozzles

musty, stale atmosphere in the room for breathing purposes, approximately 10 percent make-up air is admitted to the system.

The pump room, 24 ft below grade with 20 ft concrete walls, houses four 7000 gpm vertical centrifugal pumps, 10 smaller motor driven pumps, 475 linear ft of 12 to 42 in. cold water piping, many small pipes, and a large amount of electrical wiring, control equipment and motors. As the room is almost completely surrounded by water, it is desirable that any leakage through cracks in the walls be discovered at an early stage. Prior to the dehumidification equipment, this was almost impossible. A steady stream of water might trickle into the room before a crack was noticeable.

Dehumidifier Operating Principles

The most humid air conditions for this system to handle occur during the month of May, when 50 percent fresh air might be admitted to the system, as shown in the schematic air flow diagram, Fig. 4. Total water removed from the air by the dehumidifier under such conditions is 420 gal per day for the pump room. During late spring, the air is unusually warm and humid, and the lake water is cold. The 40 F lake water shown on the diagram passes through cooling coils in the air washer so as to control the temperature of the liquid absorbent. Air to be dehumidified makes contact with the absorbing solution, and, at the same time, both air and absorbent flow over the cooling coils. Capacity of the absorbent to retain water increases as it is chilled, and its freezing point is well below −100 F, thereby eliminating any frosted cooling coil problem in the subfreezing temperature range. The solution merely absorbs all water released by the air in the washer. Fig. 5 is a schematic drawing of the principles of operation of the humidity conditioning equipment.

The 25 psig steam shown on the air flow diagram is utilized in the regenerator chamber coils. Here, a small portion of the absorbent is automatically restored to its original moisture absorbing strength on an intermittent basis as dehumidification air conditions dictate. Again, the solution is flooded — this time over steam coils —, the absorbed moisture is driven off, and, finally, this unwanted moisture is exhausted to the atmosphere by a scavenging air stream. Incidentally, this same steam supply is used for the preheat coil when it becomes necessary to heat fresh make-up air to 60 F during winter operation.

How Air Is Circulated in Filter Galleries

A different arrangement for circulating the air from the dehumidifiers is used in the filter galleries. Here, advantage is taken of the gallery lay-

out to provide a natural circuit for the dried air, as shown in Fig. 6. The galleries themselves are completely enclosed, concrete-hallway affairs. Although booster fans are shown in the drawing, it has been found unnecessary to utilize these to afford efficient air circulation.

The total volume of the galleries is 1,350,000 cu ft. Water piping, chemical solution piping, steam piping, air piping and electrical conduits pass through the galleries. With no make-up fresh air admitted to the system, an air change occurs every 39 minutes. A 10 percent make-up air provision has been made, however, to permit maintaining a positive pressure in the galleries.

Two Dehumidifiers Dry Galleries

The two humidity conditioning units operating in the galleries have a 17,500 cfm air capacity each, allowing for a total air circulation of 35,000 cfm. In this instance, the air washer and regenerator are separate pieces of equipment, installed adjacent to each other in the space provided. Fig. 7 shows one of the air washers.

Operation of both the dehumidifying equipment and of the complete air conditioning cycle is practically identical to that for the wash water pump room. Incorporated in Table 1 are pertinent air conditioning equipment operating data for the filter plant. The dry bulb temperature in the galleries varies from 40 to 72 F the year 'round, depending primarily upon the lake water temperature. However, the relative humidity, which is considerably more important, varies only between 45 and 55 percent, which range is sufficiently low to prevent condensation.

These dehumidifying units require only occasional inspection. They are shut down to be cleaned annually to guard against possible breakdown and to insure premium performance. Otherwise, little maintenance is necessary.

Dehumidification Results in Graph Form

The moisture removal results of the dehumidification equipment installation in the galleries may be noted in Fig. 8. These three hygrographs recorded the quantity of moisture in the filter gallery air in terms of percent relative humidity during the periods indicated on each. The top chart is for the week of July 3, 1950, prior to the dehumidification system. During the summer's hot months, relative humidity ran 96 percent. The middle chart is for the week of September 11, 1950, during

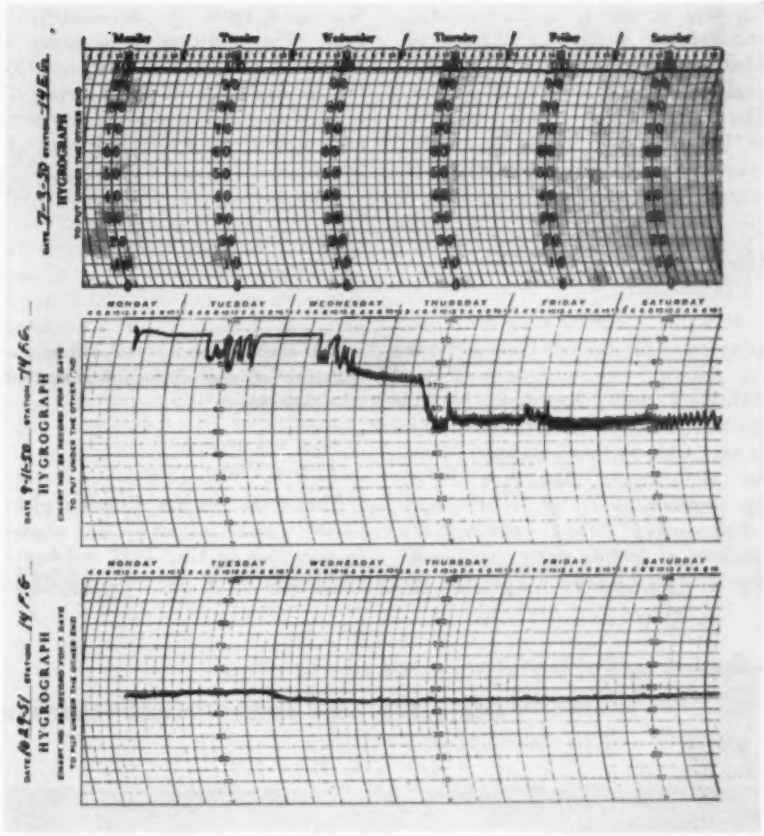


FIG. 8—THESE HYGROGRAPHS point-up pictorially the moisture reduction obtained in the filter galleries through installation and operation of the dehumidifying equipment: (Top) before dehumidifiers were installed. (Center) during starting-up of dehumidifying units. (Bottom) after dehumidifiers had been in operation for 15 months

FIG. 9—AERIAL VIEW of Chicago's $27 million south district filtration plant, put into operation in 1947 to supply an average of 317 million gallons of pure water per day to the city's south side

the days of starting up the humidity conditioning units. In a space of hours, relative humidity fell from a peak of 95 to a low of 50 percent. The bottom graph is for the week of December 29, 1951, 15 months later, and illustrates the steady year 'round level held at approximately 45 to 50 percent relative humidity.

Operating Costs Tabulated

In Table 2 are approximate operating costs for the two units serving the galleries. Compressed air is an additional utility required, but is omitted from the table since its cost is negligible in this instance. Power for all motors, other than the 2 hp regenerator motor, is required continuously. Steam consumption, quantity of cooling water, and power for the regenerator motor are all dependent upon the dehumidifying load. The total cost of operation is extremely small when compared to the savings obtained in the cost of repairs to filter control equipment and piping, of repainting, and of improved working conditions.

Cost savings of instrument and filter equipment maintenance, particularly regarding corrosion, should more than pay for the cost of the dehumidifying equipment in a period of two to three years. In fact, paint cost savings alone will allow amortization of the dehumidifying system in five years.

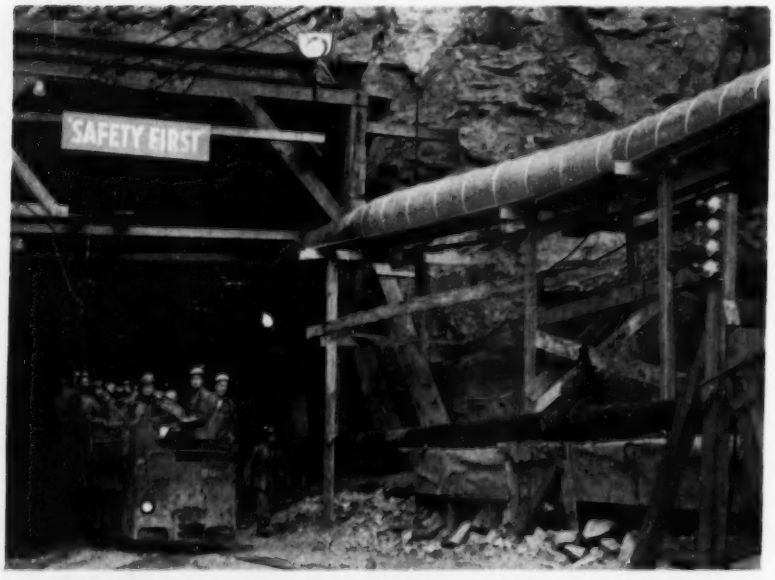
World's Largest Filter Plant

This south district filtration plant — the world's largest — was placed in operation in May 1947 and has a rated capacity of 326 million gallons of water per day, and an actual peak operating capacity of 600 mgd. Normal daily operations average around 317 mgd. Total construction cost amounted to $27 million in order to provide pure water for Chicago's south side — approximately 53 percent of the city's area. The entire filtration process includes chlorination, addition of activated carbon, coagulation, sedimentation, and filtration. An aerial view of the plant is shown in Fig. 9.

Another filtration plant for Chicago's central district is now being constructed. Dehumidification equipment similar to that in the south district plant is considered essential for this new structure.

[All illustrations courtesy of Surface Combustion Corp.]

CANADIAN POWER PROJECT POSES VENTILATION PROBLEMS



TYPICAL TUNNEL PORTAL of the immense underground workings in the huge Alcan hydroelectric project in northern British Columbia. The 24 in. welded steel ventilation pipe is shown at the upper right portion of the entrance. The smaller pipes are for water and compressed air to operate the rock drills. (Photo courtesy International Harvester Co.)

THE VAST UNDERGROUND workings connected with the Aluminum Co. of Canada's immense hydroelectric power project, located in the wilderness 400 miles up the British Columbia coast from Vancouver, pose special problems in ventilating and piping.

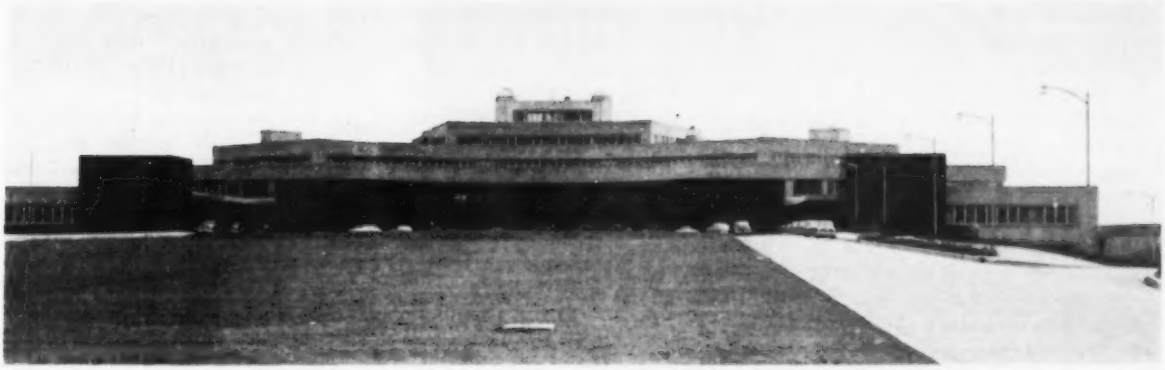
In this wilderness area, the world's largest power house is being built inside a mountain to protect it from rock slides, heavy snows and the possibility of air attack.

Since the entire power house, a cavern two blocks long and eight stories high, as well as the penstocks and a subway-size tunnel 10 miles long carrying water from a chain of lakes back of the coastal mountains, must all be dug from solid rock far below the surface, ventilation is a prime problem. The men working at the headings of the tunnels must have a constant supply of fresh air, and providing this vital necessity is not easy at distances some two miles from the surface.

Crawler tractors such as a huge 180 hp machine and numerous diesel powered haul units operate in the underground workings. Exhaust from these units must be cleared from the air rapidly to prevent contamination.

All of the tunnels carry a 24 in. welded-steel ventilation pipe through which air is forced by electric powered blower fans to within 200 ft of the actual heading where work is in progress.

To further lessen the degree of air contamination, the tractors which must work constantly underground have been equipped with a "scrubber" which removes a large portion of the carbon monoxide from the exhaust.



THE "MIRADOR" is the penthouse in the center of the terminal building's roof, where weather balloons are released. Their drift is observed through the theodolite under the dome to the left

Air Conditioning Terminal Building

. . . . for the new Greater Pittsburgh airport. Careful design meets the varying needs, includes central system for heating and cooling parked planes

By Theo. F. Rockwell
Consulting Mechanical Engineer

THE SOUTH DOCK of the terminal building at the Greater Pittsburgh airport, which is the only one built at this time, extends due south for a distance of over 700 ft from the main entrance. Ultimately, there will be east and west docks of similar size, which will increase the port capacity from 16 to 30 gates.

In the present structure, space has been allotted for:

1) Ticket offices for five airlines.
2) Passenger lounges for each airline.
3) Office space as required by the airlines.
4) Baggage rooms.
5) Observation lounges and decks for the general public.
6) Offices for the county aviation department.
7) Quarters for ground crews and airlines' communications.
8) Cafeteria.
9) Coffee shop.
10) Dining room and terrace.
11) Post office.
12) Branch bank.
13) Drug store.
14) Cocktail lounge.
15) Motion picture theater.
16) Barber shop and beauty shop.
17) Miscellaneous stores and shops.
18) A 62 room hotel.
19) Dormitories for airlines' crews.
20) Interior and exterior display windows.
21) Weather bureau.
22) Civil Aeronautics Administration offices.
23) Traffic control tower.
24) Cargo storage.
25) Public garage.

Air Conditioning Needs Vary Greatly

The summer and winter air conditioning requirements vary greatly for occupancies as diverse as this list indicates. For example, the summer load varies in intensity from 2 Btu per hr per cu ft for the mail room to 12 Btu for the control tower.

The business of transporting passengers by air goes on 24 hr a day and seven days a week; thus, all space occupied by the airlines is in use around the clock. The cafeteria, the coffee shop and the drug store are there to serve the needs of passengers and airlines' personnel; consequently, they follow suit. The theater operates from 2 to 11 p.m., the main dining room from 5 p.m. to 2 a.m., and the various shops at hours to suit the whims of their managements and customers.

The loads vary not only with the seasons but also with the time of day. Although the 1952 cooling season was severe, there were nights during July and August when it was necessary to heat the control tower for the comfort of the operators. During September and October, the daily range between maximum and minimum temperature was very wide. Nearly every day, the system operator found it necessary to switch from heating to cooling and back to heating.

A great deal of time was required in the early stages of design to establish a policy as to the extent of summer air conditioning. County officials were hesitant to approve plans for cooling the entire building. Preliminary negotiations with the airlines had indicated they did not wish to pay the charges for summer air conditioning in all rooms they intended to lease. Also, the nature of the business that would be conducted by the future tenants of many of the shops was unknown.

Three Classes of Space Involved

The spaces in the terminal building fall into three classes when require-

ments for heating and air conditioning are considered.

The assignment of space for the various restaurants, the drug store, the barber shop and the theater was definite from the beginning. It was agreed that these spaces were of sufficient importance that separate facilities be provided for each which would permit heating or cooling independently of the rest of the building.

In the second category are the airlines' and administration offices, the hotel rooms and the small shops. Summer air conditioning was to be provided for these spaces, but it was not considered essential that the occupant have the option of either heating or cooling his room independently of others in similar quarters.

The third type of space includes toilets, storage rooms, stair towers, etc., for which heating only was to be provided.

Four Piping Systems Selected

Four piping systems were selected to meet the requirements of the several types of conditioned and heated spaces:

1) Steam supply and condensate return.
2) "High temperature" hot water.
3) Combination chilled and hot water.
4) Chilled water.

Steam is used for tempering and reheat coils in the larger air conditioning systems, for domestic water heating and for cooking. The "high temperature" water circuit (200 F maximum) is used for radiators in toilets, stair towers and hotel bathrooms, and for unit heaters in some storage rooms. The combination circuit supplies water to room unit air conditioners in hotel rooms and small offices and to local unit air conditioners in the smaller shops and waiting rooms. Chilled water is piped to the cooling coils in all main air conditioning systems.

Fan Room Locations Difficult To Find

Suitable locations for fan rooms convenient to the air conditioned spaces and also to a source of outside air were difficult to find. Space to install return ducts as well as supply ducts was also lacking. Therefore, a system of primary air fans was adopted to supply a satisfactory minimum amount of ventilation air to all conditioned spaces on the field, main and mezzanine floors where it was not practicable to use conventional air conditioning systems.

The primary air systems deliver approximately 15 cfm per person for normal maximum occupancy. The total primary air is roughly twice the amount removed by toilet and bathroom exhaust fans, but this has caused no unsatisfactory air movement within the building.

The primary air systems each consist of an electrostatic air cleaner, a tempering coil, a cooling coil, a reheat coil and a fan. Three fans serve the airlines' offices, ticket counters, lounges and stores on the field and main floors. Two more supply ventilation air for the hotel rooms and dormitories on the mezzanine and second floors.

Two methods are used to introduce primary air into the conditioned spaces. In stores, passenger lounges and the coffee shop — where there is a local unit air conditioner — the primary air is mixed with recirculated air at the inlet to the unit. In small offices and hotel rooms — where room unit air conditioners are used — the primary air is introduced directly into the room through a grille or diffuser.

The primary air system also provides a method for doing some cooling during mild weather when it sometimes becomes necessary during the middle of the day. The heating controls for the three primary air fans which serve public spaces are adjusted for a fan discharge temperature of 60 F. The two primary air fans for the hotel are controlled at 70 F during the heating season.

When the cooling requirements increase to the point that 60 F primary air is not sufficient to prevent overheating — but still not severe enough to put chilled water into the combination circuit — local chilled water pumps may be started for the primary air fans so as to supply primary air at 51 F. The temperature controls for primary air fans are interlocked so the steam valve on the tempering coil cannot open if the chilled water pump is operating.

Conventional Systems for Several Spaces

The theater, main dining room, cocktail lounge and banquet rooms have conventional summer-winter air conditioning systems. Zone reheat coils in the dining room take care of different exposures. Zone coils in the banquet room system provide individual room control.

It was necessary to locate the air intakes for these systems and the discharge from the kitchen exhaust fans on the opposite sides of the air conditioning penthouse. Hence, odor adsorbers were installed in these systems.

Two Types of Room Unit Air Conditioners

Two types of room unit air conditioners are used. Those in airlines' offices and in the hotel rooms are a recirculating type equipped with filter, coil, fan and motor. Water is supplied to the coil from the combination chilled-hot circuit. The local control is manual and entirely in the hands of the room occupant. The fan motor is two speed. The flow of water to the coil is controlled by a ball type plug valve. Each unit has a metal plate bearing detailed instructions on how to vary the output of the unit. The system operator determines whether chilled or hot water is circulated, based upon information from the Weather Bureau.

The manual control has been satisfactory in offices, because employees quickly grasped how to select fan speed and valve setting; but, sometimes, there have been hotel guests who want these simple tasks performed by others.

The offices of the U. S. Weather Bureau and the Civil Aeronautics Administration are on the third floor. The peculiarities of the structural framing made a duct system impractical. Therefore, a type of room unit air conditioner with a fan and coil for outdoor air and a second fan and coil for return air was chosen for these offices. These units are supplied with water — either chilled or heated as the weather dictates — through a separate piping system which has its own pump. A separate converter is used also because the exposure of the third floor differs greatly from the rest of the building.

The outdoor air coils in these units are uncontrolled, except for the central control over chilled or heated water temperature. This is a precaution against freezing in winter and provides maximum dehumidifying in summer. A separate dual temperature room thermostat for each unit is used to control water volume

to the return air coil. The original automatic summer-winter changeover thermostat has been abandoned in favor of a manual switch. The outdoor thermostat did not respond rapidly enough to compensate for solar gain through the windows or secondary radiation from the surrounding roof deck.

How Control Tower Is Handled

Above the third floor, there is a two story tower 19 by 17 ft in plan. The upper floor is the traffic control tower, and the lower floor houses electrical equipment required for traffic control.

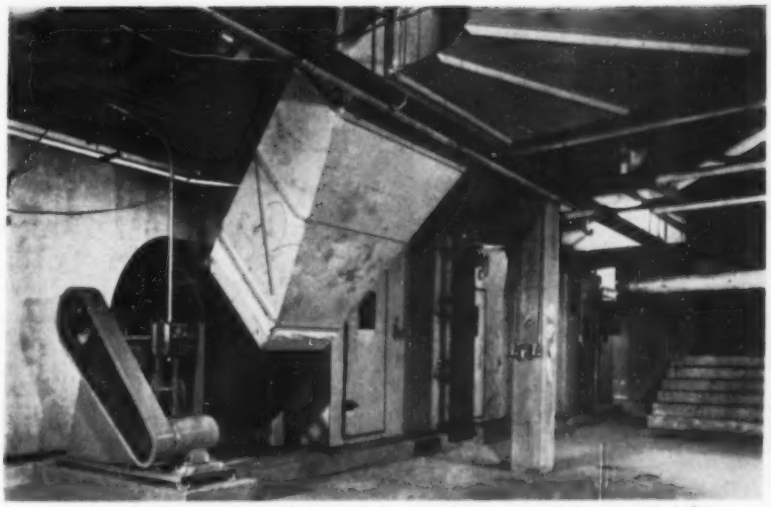
Comfort cooling is required for the tower operators, and a limitation on maximum temperature is required for the electrical equipment. Two self-contained unit air conditioners were installed, one for each floor, to make cooling available independently of the main compressor. A heating coil is installed in the discharge duct of the tower unit.

The control tower walls are of course nearly all glass. The operators' desk is along the south wall facing the runways. With the cooperation of the CAA, the desk was moved about 6 in. from the wall — a sufficient distance to install four long narrow grilles at desk height. Discharge is vertically upward. The return air grille is in the wall of the stairway leading to the tower. The system has operated for heating or cooling without objectionable air motion. The control tower unit has an outdoor air intake, but the equipment room unit merely recirculates room air because its function is to maintain room temperature within narrow limits so the communication equipment will stay in adjustment.

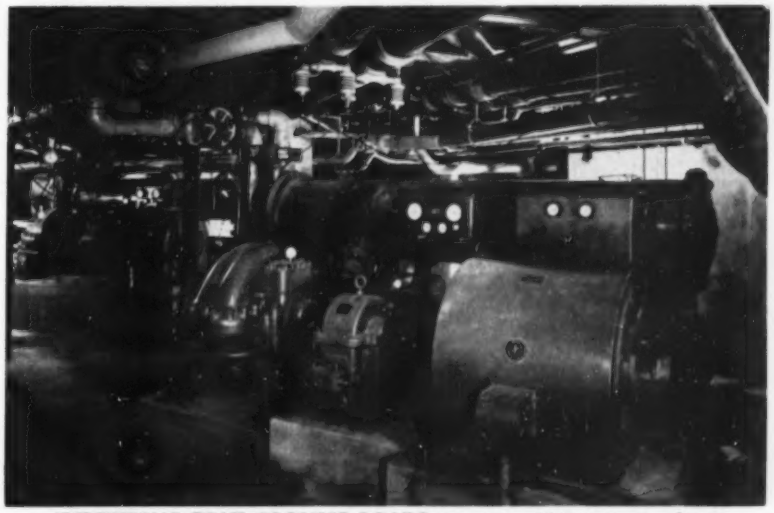
The Cooling and Heating Loads

The long axis of the present building (over 700 ft) is due north and south. Thus, the maximum heat gain due to solar radiation on glass occurs at 8:00 a.m. and 4:00 p.m., sun time. The afternoon peak is naturally the more important one because it generally coincides with the maximum daily dry and wet bulb temperatures.

Calculations were made for maximum load in each air conditioned space, with due consideration for exposure, time of maximum occupancy, etc. The sum of these individual peak loads amounts to 1000 tons of refrigeration. A study of the probable peak load at one time on the refrigeration equipment led to the conclusion that a 70 percent load factor could be applied to the selection of the compressors.



THIS PRIMARY AIR FAN, located in an enlargement of the tunnel under the south dock, supplies three floors of the south dock. Duct insulation had not been completed when photo was taken



INDIVIDUAL PEAK COOLING LOADS amount to 1000 tons, so using a 70 percent load factor, two 350 ton centrifugal refrigeration compressors were installed. Insulation and wiring not completed when picture was taken

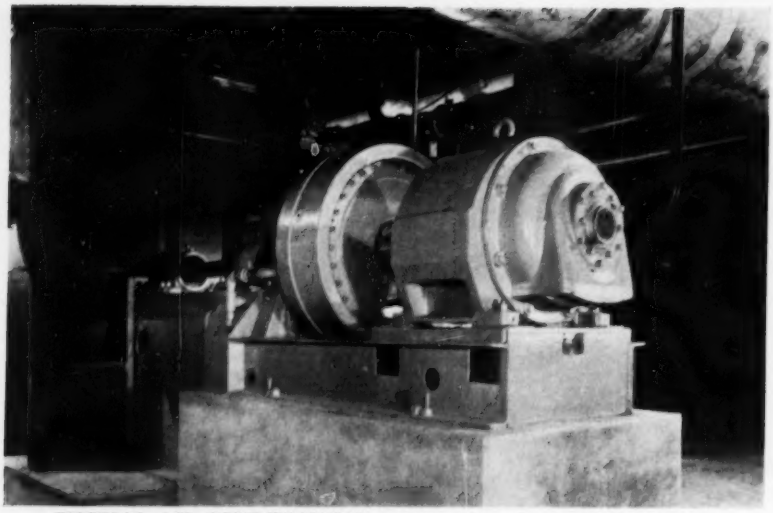
Accordingly, two 350 ton centrifugal compressors with water chillers were specified for the first phase of construction. The air conditioning system operated all through the summer of 1952 — one of the most severe in the Pittsburgh district (as elsewhere) for many years — and the compressors had no difficulty in maintaining the water off the chiller at the design temperature.

Double Glazing Cuts Cooling, Heating Loads

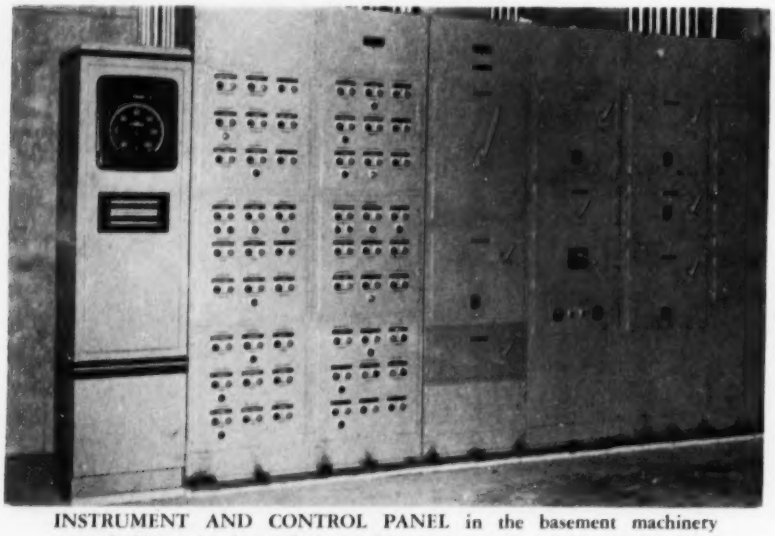
The amount of glass used in the building made a detailed study of the advantages of double glazing very important. The study indicated that double glazing with heat absorbing glass for the outer pane would be highly desirable throughout the building. (It should be kept in mind that the north wall of the building is not a straight line running east and west but the concave arc of a circle.)

The total double glazing amounts to 33,750 sq ft, of which 8600 sq ft was installed in spaces which are heated only.

The reduction in cooling load re



CENTRAL AIR CONDITIONING system with underground ducts serves the parked planes at the airport. This high pressure blower is for the south dock system. Final design calls for two more systems



INSTRUMENT AND CONTROL PANEL in the basement machinery room facilitates heating and air conditioning operation. Some of the signal lights indicate the relative demand for cooling to the watch engineer

sulting from double glazing is 120 tons of refrigeration and the reduction in heating load is 1,600,000 Btu per hr.

It was definitely agreed before the design of the heating and air conditioning system was completed that double glazing would be used. Equipment capacities were adjusted accordingly, and it is estimated that the initial cost of the system was reduced by $40,000 to $50,000.

Double glazing will also reduce operating costs because of lower energy requirements. The current rates for electrical energy and make-up water amount to 1.5c per ton per hour. Present fuel rates make steam cost about 66c per 1000 lb. With these costs, the estimated annual saving in operating cost is:

Heating season	$2160
Cooling season	1570
Total	$3730

Condensing water is cooled in a redwood, induced draft cooling tower which is concealed in the east pylon. Space is available in the west pylon for a future tower. A separate condensing water pump is used for each compressor.

Exhaust Ventilation Solves Special Problems

In addition to the usual exhaust ventilation for toilets, bathrooms, etc., the terminal building has some special problems. There is a large amount of vehicular traffic on the field floor driveways, with all vehicles being operated with internal combustion engines. Although there are 10 openings from the field floor driveway onto the apron, it was not certain whether natural ventilation would be adequate to eliminate exhaust fumes. Therefore, it was decided to install exhaust duct work for the south dock driveway but to omit the fan until it was found out whether it would be necessary. The operating experience of the first five months indicated that natural ventilation is adequate to care for the traffic at this time.

The mail and cargo room is essentially an underground structure below the main entrance driveway. There is a large truck dock provided for the convenience of the Post Office and the handlers of air freight. Because of the habit of the truck drivers to park with engines running, it was felt necessary to provide mechanical exhaust ventilation at this location to overcome any tendency of exhaust fumes to drift into the mail room where clerks are handling air mail. An underground duct system extends the entire length of the dock with an exhaust grille at each truck location. The fan is in a small room under the dock floor, and the exhaust air is discharged through a duct in the west pylon.

A carbon monoxide exhaust system was installed in the garage to provide for the removal of exhaust fumes when mechanics are tuning or testing motors. Capacity is adequate for four cars.

There are two main kitchens, two service kitchens and a bakery in the building. None is located so sufficient air to balance the kitchen exhaust can be taken from adjoining air conditioned spaces. Therefore, supply fans were installed to furnish tempered air equal to about two-thirds of the volume handled by the exhaust fan. The starting and stopping of the fans is under the control of kitchen personnel, but the fans are electrically interlocked so that the exhaust fan cannot be operated without simultaneously operating the supply fan.

A similar combination supply and exhaust system was also installed for the projection room of the theater.

Central Air Conditioning System for the Planes

The operation of the heating and ventilating systems of most current transport planes depends upon the forward motion of the plane. Air speeds in excess of 100 mph are generally required to produce adequate circulation through the restricted duct system of a plane.

The cabin temperature of a plane docked at an airport is affected very quickly by outdoor temperature, and in severe winter or summer weather the cabin soon becomes uncomfortable for passengers.

Mobile air conditioning units have been used at major airports for many years to provide heating or cooling for parked airplanes. The Allegheny county department of aviation, however, desired to reduce as far as possible the vehicular traffic on the apron. Therefore, the design of a central system for heating and cooling the planes was authorized.

This problem is somewhat similar to that of the railroads in their passenger car yards at terminals, but it differs in that there is no standard size of transport plane and there are no standards for location of external duct connections or for duct size and resistance. The design work for this system was done in 1947. At that time, the airlines flying into Pittsburgh thought that the largest plane that would use the new terminal would have a capacity of 60 to 65 passengers. The Douglas DC-6 is typical of this size of plane, and the builders stated that the plane required air circulation at the rate of 1200 cfm.

The final design calls for three fan systems, one for each dock. Only the south dock system has been installed at this time but the other two will be installed as the other docks are completed.

The duct system is underground and is built of spirally welded steel pipe. There is a branch line for each plane gate terminating in a blast gate located in a pit. The trunk duct has been extended just beyond the present limits of the apron paving, making conditioned air available at 16 gates, but this has been found to exceed the economic limit of duct length for air supplied from one fan.

The fan room is in the basement of the south dock. The system consists of an outdoor air intake, electrostatic air cleaner, heating coils, cooling coils and high pressure blower.

The final connection between the blast gate and the plane is made with a hose furnished by the airline. Not all of the airlines using the terminal have provided themselves with hoses; consequently, the maximum load at any one time has been five or six planes, although the system has a capacity of 10 planes.

The fan is driven through a fluid coupling which permits variation of fan speed as required by the demand on the system. Naturally, the layover time for a plane must be kept to a minimum; therefore, it is necessary to keep the system in operation so temperature equilibrium may be established very quickly after connection is made to the plane. Fan speed is automatically increased when a blast gate is opened.

The heating coil capacity is sufficient to maintain a fan discharge temperature of 175 F at —10 F outdoors. The heating coils are controlled from a fan discharge thermostat.

Automatic control was originally installed on the cooling coil, but it was removed because the experience of the past summer indicated that the variable air quantity afforded enough control and because it was desirable to supply air at the minimum dew point possible.

Centralized Instruments Aid System's Operation

Machinery which makes up the heating and air conditioning system is widely scattered throughout the terminal building. The system is operated by a watch engineer on duty in the basement machinery room. He has an assistant who patrols the various fan rooms and who responds to complaints from various building occupants. Pressure gages are installed in important locations on steam lines and on the inlets and outlets of all large pumps. Thermometers are freely used to measure the temperature of the air and water at various points in the main air conditioning system.

But it was felt that, in addition to these instruments, the watch engineer should be provided with some remote indicating device which would keep him informed of the demands on the air conditioning system. Each of the large fans and pumps is provided with a set of red and green pilot lights located on an instrument panel in the basement machinery room. The red light indicates that the fan or pump is operating and the green light indicates that it is not.

There has been much experience in air conditioned buildings which has demonstrated that often the occupants desire to have the cooling system operate during what is normally considered to be the heating season. Therefore, a signal system was installed to indicate to the watch engineer whether there is sufficient demand for cooling to justify the operation of one of the compressors. A yellow signal light was connected to the primary thermostat of each of the major air conditioning systems. When the temperature in any of these air conditioned spaces rises to the point where it starts opening the chilled water valve on the coil, it simultaneously lights the yellow signal light on the control board. Thus, if only one or two lights are on, it may indicate to the operator that there is not sufficient demand to operate a compressor. On the other hand, if three or four lights are on, it indicates that operation of the cooling system is required.

In addition to this, there is a remote temperature indicating system to the right of the control panel which may be used by the watch engineer to determine temperatures of various parts of the building, and he may use these to guide himself in the operation of the system. He may also determine outdoor temperature by this instrument.

As the kitchens are operated as concessions, steam flow meters were installed to determine the consumption of steam for kitchen purposes.

McGinness, Smith & McGinness Co. was the prime mechanical contractor for the terminal building. Morgan Brothers Co. was the sheet metal contractor, and George V. Hamilton Co. the insulation contractor.

[Mr. Rockwell's article in the December 1952 HPAC explained the general design of the terminal building and the details of the separate boiler house which serves it.]

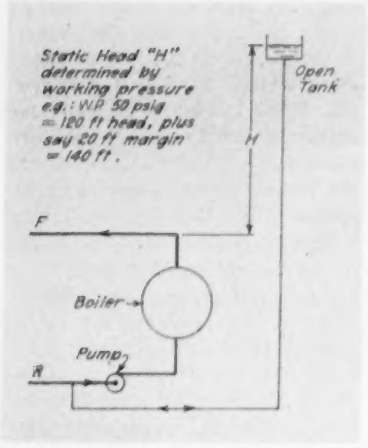

Static Head "H" determined by working pressure e.g.: WP 50 psig = 120 ft head, plus say 20 ft margin = 140 ft.
Open Tank
H
F
Boiler
Pump
R

FIG. 1—ELEVATED TANK is perhaps simplest method of pressurizing

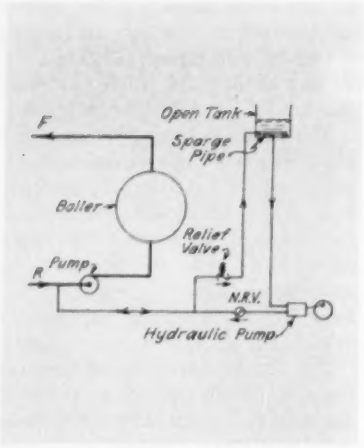


FIG. 2—"ARTIFICIAL" HEAD may be provided by a hydraulic pump

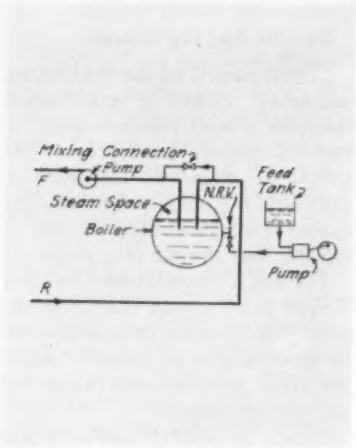


FIG. 3—MOST COMMON METHOD of pressurizing is by steam

Pressurizing HPHW Systems

. . . . with nitrogen and other methods

By J. R. Kell

Partner, Oscar Faber & Partners
Consulting Engineers, London, England

Pressurization of water in a heating system by nitrogen appears to be advantageous in principle. It is not yet known, however, to what extent the additional complication is worthwhile, or whether other methods of avoiding aeration are practicable or preferable.

It is a subject which at the moment is open for discussion and experiment.

THE PURPOSE OF pressurizing the water contained in a heating system is to enable its temperature to be raised above atmospheric boiling point. With higher temperatures smaller emitting surfaces are used, bigger water temperature drops, and hence smaller piping.

Boiling points of water at various pressures are given in Table 1.

A *medium pressure* hot water system may be taken to signify one with a working pressure up to about 50 lb per sq in. gage (psig) at the highest point in the circulating system.

A *high pressure* hot water system (HPHW) usually signifies one working at pressures from about 80 to 250 psig or over.

Mr. Kell is president of the Institution of Heating and Ventilating Engineers (British "counterpart" of the American Society of Heating and Ventilating Engineers.)

How to Obtain the Pressure Head

The pressure head may be obtained in a variety of ways, as follows:

1) *The simplest method is obviously an elevated tank, as in Fig. 1.* This method is not often practicable owing to the great height required for the tank. Some means of cooling the water of expansion may be necessary if the return is above 212 F; otherwise, the expansion tank may boil.

2) *An "artificial" head may be provided by a hydraulic pump, as in Fig. 2.*

TABLE 1—Boiling points of water at various pressures

Pressure above atmospheric psig	Boiling point temperature, F
0	212
5	227
10	239
20	259
30	274
40	287
50	298
60	307
70	316
80	324
90	331
100	338
125	353
150	366
200	388
250	406
300	422

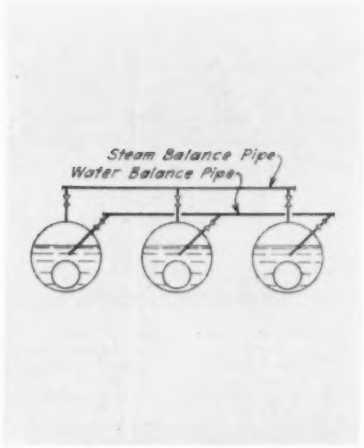


FIG. 4—STEAM AND WATER BALANCE PIPES are necessary here

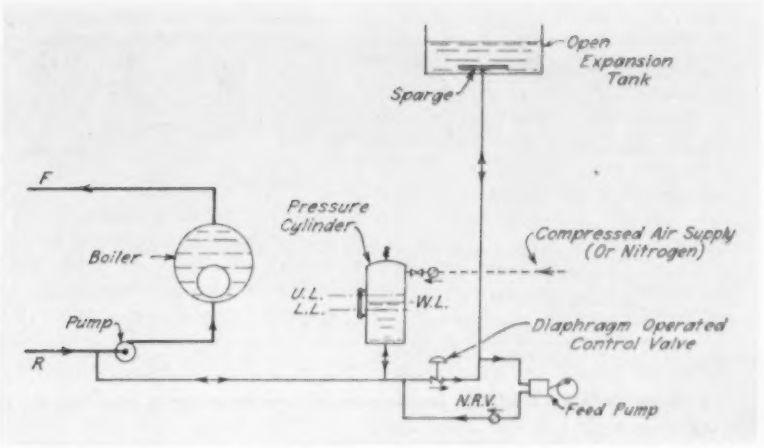


FIG. 5—BOILER AND HEATING SYSTEM are completely filled with water in this scheme

In this case, the water of expansion escapes through the relief valve and on cooling and contraction the water in the system is replaced by the hydraulic pump. This kind of system does not yet appear to have been adopted in practice. There would be certain problems to be overcome in the matter of pressure control due to there being no cushion of any kind.

3) *Probably the most common method of pressurization of a HPHW system is by steam, as in Fig. 3.*

The steam above the water in the boiler or steam drum is formed at a pressure corresponding to the water temperature.

To prevent ebullition, return water through a mixing connection is frequently injected into the flow as shown, so as to reduce the outlet temperature.

Where more than one boiler is required, steam and water balance pipes are necessary, as in Fig. 4; these are independent of the normal flows and returns and are to insure uniformity of water level in all boilers.

In operation, this kind of system has some drawbacks due to the ebullition temperature and corresponding pressure being closely interdependent. For instance, great care has to be used in bringing an extra boiler into use and in opening up the valves in a fresh circuit. Any slight drop in pressure may cause steam formation and water hammer, which can be alarming.

4) *The present article is concerned with pressurization by a gas, such as air or nitrogen, contained in a vessel forming a cushion on the system to which it is connected.*

Pressurizing by Air or Nitrogen

There are three variations.

a) *The boiler and heating system are completely filled with water, as in Fig. 5.*

The cushion cylinder has water to a halfway line and air or gas above. Pressure is applied by an air compressor or from gas bottles up to the designed head.

As water in the system expands with heating, it enters the cylinder at the bottom, causing the water level to rise. When the upper limit of level is reached, the electrical control causes the relief valve to open and water escapes into the open expansion tank until a lower limit is reached when the relief valve is shut off. The size of the cylinder is so arranged that the slight change of pressure caused by the change of level of water in the cylinder is small compared with the total pressure on the system.

As water in the system contracts, the water level in the cylinder falls, and at a certain point the level controller starts up the hydraulic feed pump which returns water from the tank to the system. When the upper level is reached in the cylinder the feed pump is automatically stopped.

The pressure to be applied is determined by the maximum boiler temperature desired, which gives the corresponding pressure, plus the head corresponding to the level of the highest point above the boiler and pressure vessel, plus a margin as considered desirable.

In this form of system the pressure cylinder is small; for example, in one case with a boiler output of 60 million Btu per hr, the cylinder was approximately 4 ft diameter by 8 ft high, but the expansion tank was of 10,000 gal capacity.

With multiple boilers, there are no balance pipes as the boilers are completely filled.

The system is inherently simpler to operate than with the steam pressured type due to the fact that temperature and pressure are independent. A good margin of pressure can be preserved throughout the system, thus avoiding dangers of steam formation.

b) *The second variation is shown in Fig. 6 and has the same advantages, with some others besides.*

In this case the system and boiler are completely filled with water as before, but the whole water of expansion is accommodated in a large vessel and is thus not brought into contact with the open air as in the previous example.

This system is thus a truly closed one.

Pressure is applied to the upper part of the expansion vessel either by air compressor or by nitrogen, and is kept constant (within small limits) by the self opening of the relief valve with rising level, and by the action of the compressor on falling level. Any water needed to replenish that in the system is introduced by the feed pump which would be started up by hand or automatically when the water had reached

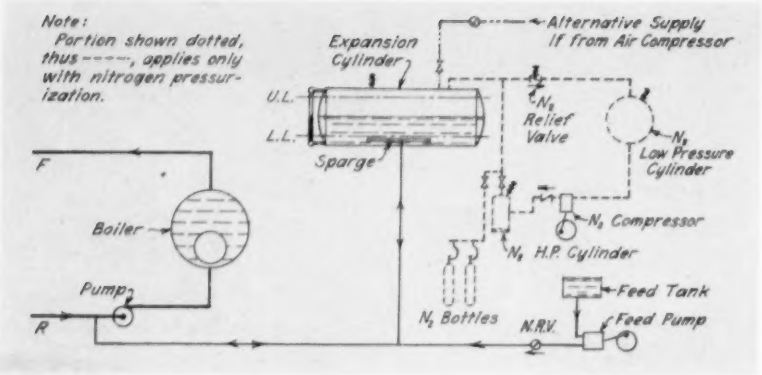


FIG. 6—THIS VARIATION has the same advantages as Fig. 5, plus others

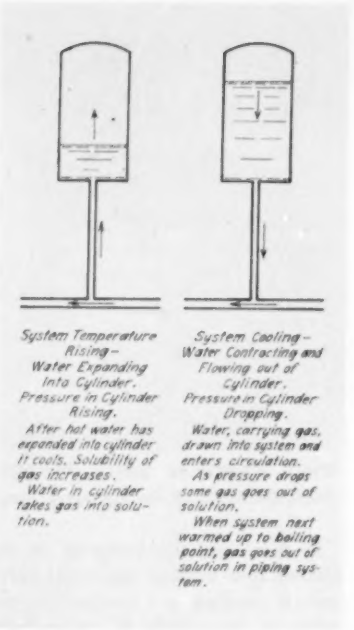

System Temperature Rising—
Water Expanding Into Cylinder.
Pressure in Cylinder Rising.
After hot water has expanded into cylinder it cools. Solubility of gas increases.
Water in cylinder takes gas into solution.
System Cooling—
Water Contracting and Flowing out of Cylinder.
Pressure in Cylinder Dropping.
Water, carrying gas, drawn into system and enters circulation.
As pressure drops some gas goes out of solution.
When system next warmed up to boiling point, gas goes out of solution in piping system.

FIG. 7—WHAT HAPPENS when the system temperature is rising

FIG. 8—. . . AND WHAT HAPPENS when the system temperature is cooling

its lowest permissible level.

If nitrogen is used instead of air, and so as to save continual replenishment from bottles, the outlet from the relief valve can be arranged to discharge into a low pressure cylinder from which the compressor takes its supply.

The pressure cylinder with this system is much larger than with the previous example, but there is no open expansion tank. The pressure vessel in both cases needs to be constructed for full boiler pressure. The size of the pressure cylinder is determined by the water content of the whole system, the diurnal temperature range to be expected and the corresponding volume of water of expansion (it is assumed that the initial expansion from cold would be bled off the system; otherwise a much larger vessel would be required), the convenient upper and lower levels of the cylinder coming within the limits of the gage glass, a suitable margin to be allowed over the theoretical minimum.

c) A third variation is the same as (b) except that the gas cushion in the cylinder is not relieved when the water expands and the pressure consequently rises.

While this method is possible on small systems at moderate temperatures it will be found that the size of cylinder and higher pressures attained at maximum temperature render it for large HPHW systems unattractive.

Use of Nitrogen Instead of Air

We now come to a consideration of nitrogen as the pressurizing gas instead of air.

Nitrogen appears to have been first used for this purpose in Germany and was reported on by the "team" from the United Kingdom, which visited the Continent in 1946 to investigate developments which had taken place during the war years. The report on one installation is as follows:

"Variations in the volume of water due to temperature changes is taken up in enclosed expansion vessels connected at their base into the return header (pump inlet). These vessels are horizontal cylinders, with a normal water line at the center. The space above the water line is charged with nitrogen permanently connected through a pressure reducing valve to a nitrogen source at 25 to 30 atmospheres. (Byproduct nitrogen from the works, through reciprocating pumps). This cushion of nitrogen takes up normal fluctuations in working temperatures (but not initial filling). It consumes no heat, and excludes all oxygen, and is found to be superior to steam or air cushions."

The case for nitrogen depends clearly on its being chemically inert, whereas oxygen, which forms about 21 percent of atmospheric air, may be a corrosive agent in a heating system.

In the second place, N_2 is less soluble than O_2, as Table 2 shows.

What's Effect of Pressure on Solubility?

In a closed system under pressure, a perfect gas would obey Henry's Law, which states that solubility is proportional to pressure. To find the mass of gas dissolved at varying pressures, multiply the figures in Table 2 by the pressure in atmospheres. The variations from perfect gas behavior increase with temperature and pressure and data may be obtained from the International Critical Tables.

At a high pressure of 100 atmospheres and at a temperature just below 100 C (99.8 C) oxygen and nitrogen vary from perfect gas behavior by from 30 to 40 percent; i.e. $pv = 1.3750$ for O_2; $pv = 1.4114$ for N_2. At more normal pressures, however, a variation of no more than 20 percent from perfect gas behavior might be expected.

If we consider the case of a high pressure hot water heating system working at, say, 10 atmospheres (147 lb per sq in. absolute) we multiply the figures in Table 2 by 10 (subject to the slight error men-

TABLE 2—Masses of nitrogen and oxygen in grams dissolved in 100 grams of water at 1 atmosphere

Temperature, C	Nitrogen	Oxygen
0	0.002942	0.006945
10	0.002312	0.006945
20	0.001901	0.004339
30	0.001624	0.003588
40	0.001391	0.003082
50	0.001216	0.002657
60	0.001052	0.002274
70	0.000851	0.001856
80	0.000660	0.001381
90	0.000380	0.000790
100	0.000000	0.000000

(From Handbook of Chemistry and Physics, 30th edition, published by Chemical & Rubber Publishing Co., p. 1396)

tioned) in order to find the solubility of O_2 and N_2.

But as we raise the temperature above atmospheric boiling point (100 C), the gases go out of solution completely, so that we are no longer interested in their relative behavior under different conditions of pressure and temperature.

The cycle of warming and cooling, and consequent gaseous solution and release, is illustrated in Figs. 7 and 8.

Corrosive Effect of Oxygen

It appears that more research is required before an answer can be given to the question, How serious is the corrosive effect of oxygen in a heating system?

In principle — that is, qualitatively — it is clearly desirable to exclude oxygen from the inside of boilers and piping. Various forms of pitting and corrosion are known to depend on the presence of oxygen and carbon dioxide. In high pressure boiler plants, deaeration of feedwater has become a standard feature to prevent the evils in question.

Quantitatively, however, in the case of a heating system pressurized by means of air in a cylinder, just how much air is absorbed in a year it is difficult to say. Experience of one installation indicates that the quantity is insignificant but in the case of another, daily make-up is reported to be necessary. Evidently the amount of absorption depends on the frequency and degree of temperature variation with inevitable "breathing" of air into the system.

What is the extent of corrosive attack even in the latter case, however, is not known at present. Indeed, with the type of system shown in Fig. 5, the aeration of water via the open expansion tank may well be more serious than that occurring from the pressure cylinder. For this reason the system shown in Fig. 6 is to be preferred as a completely closed system.

Minimizing Internal Corrosion

From an ideal point of view it is apparent that in order to minimize possible internal corrosion in any system, due to aeration, the best design is:

a) Arrangement as in Fig. 6.

b) Pressurization with nitrogen, not air.

c) Initial filling to be with water which has been previously deaerated.

d) Subsequent replenishment to be with water similarly deaerated.

The chemical treatment of water to avoid deposits or corrosion in a HPHW system is a separate subject which is not covered by this article but is in any event desirable on a large installation.

Alternative methods of avoiding aeration with a pressurized system using air for the cushion in the cylinder may be:

i) To keep the water in the cylinder continuously above atmospheric boiling point when the solubility of gases is zero. This would mean insulating the vessel, and heating by an internal coil served off the flow and return, with some means of auxiliary heating, such as an electric immersion heater, for use when the heating system is out of action.

ii) The introduction of a layer of medicinal paraffin or similar fluid on the surface of the water in the cylinder.

So far as the author is aware, neither of these two methods has been tried out and they may have some disadvantages.

THE TUBING forms an enclosure in which unit air conditioners are placed. Its top is fastened to the test room ceiling, and it is lowered around the unit for a test. (Photo courtesy Flexible Tubing Corp.)

LARGEST FLEXIBLE TUBING HELPS TEST AIR CONDITIONERS

THE "LARGEST PIECE of flexible tubing ever made" was fabricated for the air conditioning division of General Electric Co. for use as a psychrometric calorimeter to test self-contained air conditioners. It is 7 ft in diameter and 10 ft, 2 in. long.

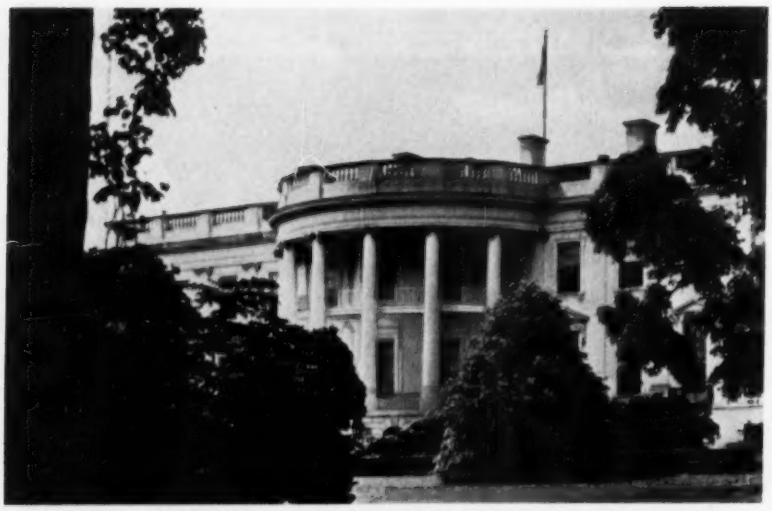
The upper end of the enclosure is secured to the test room ceiling and the lower end drawn up. The air conditioner to be tested is installed underneath, and the tube enclosure is lowered and secured to the floor. This forms a room within a room.

Warm moisture laden air is forced through an opening in the enclosure, circulated around and into the air conditioner, cooled, then drawn off through ductwork in the ceiling. Temperature and humidity readings are taken of the air entering and leaving the enclosure.

Air Conditioning a Necessity

. . . in many cities, one of which is certainly Washington, D.C. Since last summer, the President of the United States can also enjoy its benefits and comforts

By Charles Stempf and Henry A. Caldwell



THE RENOVATION AND STRUCTURAL reinforcement of the White House — completed last year — gave opportunity for installing a complete central air conditioning system

WASHINGTON, D. C., has been accurately described as a sub-tropical city. This description makes allowances for a mild but genuine winter and delightful spring and fall seasons.

But the summers!

Washington's summer climate is notorious the world over. There are days when climatic conditions approach those of a Turkish bath. To be precise, peak conditions of 106 F dry bulb and approximately 60 percent relative humidity have been recorded. This kind of weather would be called "unusual" in Manila or Rio de Janeiro.

Air Conditioning Essential, Not Just Luxury

The federal government and the commercial establishments in Washington have long realized that air conditioning has intrinsic values above and beyond its familiar function as a device for luring customers into a salesroom. In fact — far from being a mere luxury — air conditioning is essential for normal operating efficiency of personnel in a climate such as this.

That the government realizes and accepts this fact is attested by its practice of discontinuing work in buildings lacking air conditioning whenever the temperature approaches 98 F and is accompanied by high humidity.

As a result, there have been few government buildings, apartment houses, office buildings or other major construction projects in recent years where provision was not made for a central refrigeration plant to supply cooling to all parts of the building.

A spectacular indication of the extent to which Washington has been air conditioned is the load record of the Potomac Electric Power Co., which serves the District of Columbia and adjacent areas. Ten years ago, this public utility experienced its peak demand during winter evenings when heating and lighting loads were highest. Today, the peaks are encountered during mid-day in summertime, and the change is attributable almost entirely to the growth of air conditioning power requirements.

It has been regrettable, therefore, that one of the few important buildings in Washington not to have been thoroughly air conditioned until last year was the White House, itself.

The design and installation of a satisfactory air conditioning system is, of course, a relatively simple matter, providing the building is initially designed to accommodate one. To fit one into an ancient structure such as the White House, however, is a much more difficult engineering problem. Generally speaking, the best that can usually be done, short of complete renovation and reconstruction, is the installation of separate "packaged" systems in each room or group of rooms where air conditioning is most needed. This is exactly what had been done in the White House.

Renovation Gave Opportunity To Air Condition

The recently-completed program of renovation and structural reinforcement of the White House provided

the Public Buildings Administration with an opportunity to modernize the air conditioning system. Plans for location of piping and ductwork for the central system could be drawn up concurrently with the investigation of structural weaknesses.

The two centrifugal compressors which serve the system have a total capacity of 400 tons of refrigeration when cooling 960 gpm of water from 54 F to 44 F. The chilled water serves five fan coil units with a total hourly capacity of 2,838,000 cu ft of air.

All fan coil units were designed for 100 percent outdoor air. However, the three units which serve the first and ground floors normally operate on 70 percent recirculation. The remaining two units, which serve the second and third floors, operate on 100 percent outdoor air at all times.

Since the air conditioning system maintains a positive pressure inside the White House to prevent infiltration of unconditioned air from outside, an exhaust fan was provided to automatically relieve any excessive pressure which might build up. Automatic operation of the exhaust fan is actuated by a pressurestat.

The circulating water for the refrigeration condensers is cooled from 93 F to 83 F by two cooling towers with a combined air capacity of 124,000 cfm.

Refrigeration Plant, Cooling Towers Underground

The entire refrigeration plant, including these cooling towers, is located underground so that the appearance of the building and grounds is not affected in any way by its installation. The problem of exhausting the moisture-laden air from the cooling towers was solved by the construction of a concrete underground outlet, of sufficient diameter to accommodate the 124,000 cfm rate of flow. As an added complication, the outlet had to be extended halfway around the building in order to exhaust in the most inconspicuous location.

Needless to say, the plans and specifications for this important installation called for all the special fittings, accessories, and controls which would increase the flexibility and reliability of the system. All air units include air dampers and are equipped with preheat and reheat coils as well as with the cooling coils.

A central control system was provided so that uniform conditions of 78 F dry bulb and 45 percent humidity may be automatically maintained in all parts of the building and in all seasons of the year. The air units, however, were so arranged that they may be controlled either individually or centrally.

[The color coded graphic master control panel was described in an article in the June 1952 HPAC.]

After her tour of the White House with Mrs. Truman last November, Mrs. Eisenhower described the newly decorated and renovated Executive Mansion as "delightful." With its new 400 ton central air conditioning system, it will no doubt deserve even stronger words of praise during Washington's summer weather.

IMPROVED BUILDINGS AN "OVERLOOKED PHENOMENON"

ONE OF THE "great overlooked phenomena of our time" is the unprecedented number of new and improved building products which have come onto the market since the end of World War II, A. Naughton Lane, president of the Producers' Council, national organization of building products manufacturers, said in an address at the council's annual meeting last year.

"Had it not been for the trouble in Korea, and the re-imposition of materials controls, the list would have been even greater," Mr. Lane said.

"Tremendous improvements have come in every type of material and equipment. It is obvious that the manufacturers of building products have kept abreast of any other industry anywhere in technological advancement and inventive genius.

"It is most significant that much of the improvement in our products has been of a nature intended to reduce the cost of constructing homes and other buildings. Unfortunately, however, the resultant savings have been largely obscured by two wholly unavoidable forces.

"One force is the great and regrettable wave of inflation which, striking construction the same as other major industries, has pushed production costs so far above prewar levels.

"The other force, a welcome one in this case, is the insistence of the home-buying and building-owning public on getting more quality and utility and convenience in their buildings. Everyone now wants to build into their buildings at the start many features which formerly were installed as separate operations or else were not commonly available.

"You can't panel basement rooms, insulate every inch of wall and ceiling, weatherstrip every door and window, regulate every heating plant thermostatically, and double-glaze every window without adding a little something to the first cost of a building.

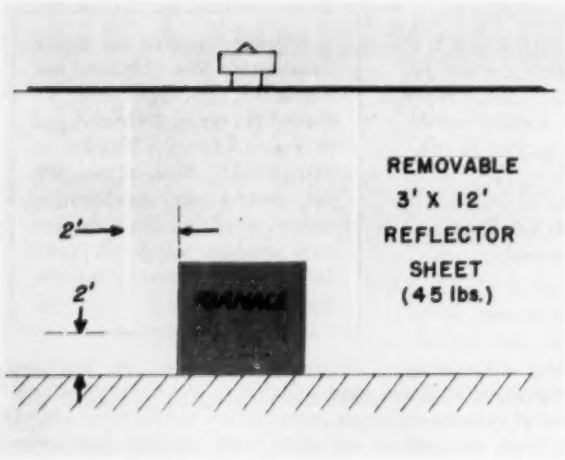
"The average new building of today, square foot for square foot, is a far better equipped product than was the new structure built 10 and 15 years ago. Had it not been for the great emphasis which the manufacturing industry has placed on cost reduction, building costs would be substantially higher than they are because of the added quality which the public demands."

SEES "BANNER YEAR" FOR AIR CONDITIONING

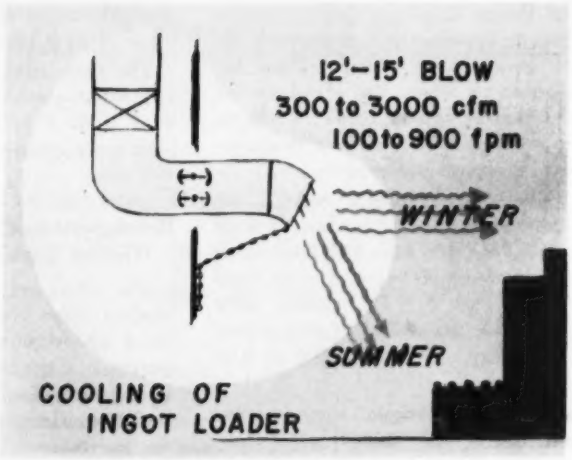
ALL INDICATIONS POINT to "a banner year" in 1953 for the refrigeration and air conditioning industry, according to the Refrigeration Equipment Manufacturers Association.

John E. Dube, president of the association, believes that any reasonable decline of general business should be offset by the growth factor of the industry.

The year 1952 saw an average increase of approximately 30 percent in the business of manufacturers over 1951 and it is estimated that 1953 will increase another 30 percent over 1952, the association says.



GLASS FURNACE with total enclosure as described



DESIGN FOR moderately distant workman

HEAT RELIEF in Industry

Comments by several authorities give further data on heat relief in hot industries by radiant heat shielding, evaporative cooling, other methods

CHARLES J. ENLIND, Contract and Control Engineer, United States Steel Co. — Mr. Small's paper on the subject of heat relief in hot industries has considerable merit in that it promotes discussion on the subject of radiant heat control. Before going into details on the subject of radiant heat, it is advisable to give attention to mill building design so that high temperatures from convection heat can be removed as promptly as possible. Where high pitched roofs are used on buildings which contain furnaces or other hot operations, a continuous ridge type ventilator will usually remove much of the waste heat attributed to convection. To insure satisfactory results, especially in windy locations, it is suggested that these continuous type ventilators be constructed with cross baffles spaced at approximately 15 ft centers. This will tend to localize any end draft that may occur.

In some buildings, much of the heat is confined to a few relatively small areas. It is then usually possible to install facilities for the removal of such heat directly at the source by means of hoods, ducts, fans, etc.

Radiant heat control, on the other hand, presents quite a different problem from that of convection heat. The use of radiation shields has been recommended where conditions permit. Protective clothing is sometimes used, but is often objectionable as it frequently adds to the discomfort of the wearer.

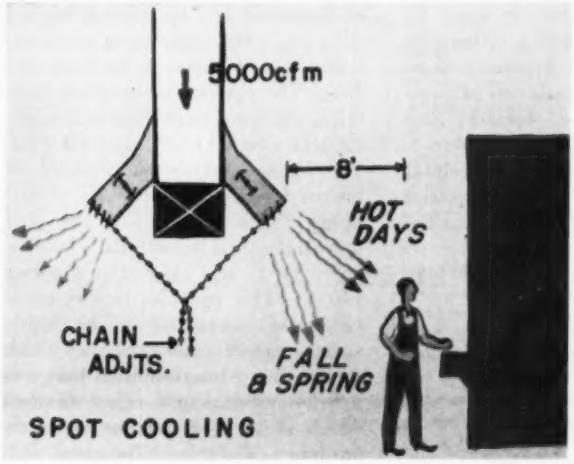
Radiant heat can only be controlled by insulating, or screening the heat sources and not by high air movement over these sources or by general ventilation, since cooling the air or increasing its velocity has no effect on radiant heat. The insulation of radiant heat sources, besides being expensive in most cases, may be impractical, because it would interfere with the workmen who must have ready access to the product. The application of insulation against radiant heat is, therefore, limited.

Screening of radiant heat is relatively inexpensive and can be adopted in most cases. Furthermore, screening has the flexibility that insulation lacks, in that it may be either fixed or movable.

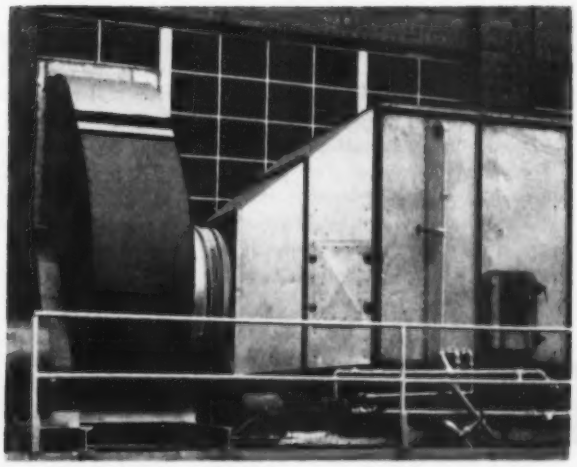
Excellent results have been obtained by using screens made of highly reflective material such as aluminum, tinplate, nickel, etc.

In many cases, screens have been made of steel or iron plates or chains which absorb radiant heat and con-

The paper on Heat Relief in Industry, by Bartlett R. Small, Staff Engineer, Mechanical Engineering Dept., Aluminum Co. of America, was presented at a meeting of the Association of Iron and Steel Engineers, and published in the AISE journal, the Iron and Steel Engineer. It was republished (with permission) in the October and November issues of HPAC to make the information generally available to ventilating, air conditioning and heating engineers and contractors and to engineers in plants who are concerned with these problems. The discussion on Mr. Small's paper is given this month.



SUGGESTED DESIGN for close quarters with third outlet for 15 ft blow not shown



COOLING "STATION" for system described previously located on nearby toilet leanto roof

vert much of it into convectional heat, the remainder being re-radiated at a lower temperature. Water cooled screens are also used in many cases.

The following applications of the reflective type of screens have been brought to our attention recently. In an open hearth department where a furnace was being repaired close to a furnace in operation, reports indicate that a reflective shield made of aluminum foil on asbestos was very effective in protecting the maintenance crew against radiant heat from the active furnace.

In reviewing several tests in which heat shields were used, it was noted in one test that an aluminum foil shield was placed 18 in. above molten steel which had a temperature of about 2800 F. In this case, 88 percent of the radiant heat from the vessel was reflected by the shield.

In another test, aluminum foil was placed in front of a furnace operating at 1300 F. In this case the back of the shield attained a temperature of 99 F when the room temperature was 65 F. At a distance of 1 in. behind the shield the air temperature was reported to be only 81 F.

Reports on these tests indicate that there was no sign of spalling when the foil was exposed 18 in. above the molten steel for 3 min or when placed 18 in. in front of the furnace at 1300 F for 3 hr.

It is believed that aluminum foil on fabric provides a good protective shield against radiant heat, but that the amount of reflectivity, and, therefore, the amount of protection afforded, would decrease greatly with dirt accumulation on the foil surface. If such a radiant heat shield becomes discolored, it loses its effectiveness. Other materials than foil-on-fabric should, therefore, be given consideration.

Several kinds of sheets have sufficient reflectivity to warrant using them for radiant heat shields. Sheets of aluminum or a light gage 17 chrome stainless strip, such as that used for auto trim, would be suitable. The 17 chrome should be a cold rolled sheet having what is known as a No. 2 finish. This type will have sufficient reflectivity without polishing and has high resistance to oxidation at high temperature. In most cases a fairly rigid shield is required, and this can be obtained by using corrugated sheets.

Recent tests indicate that it would be advisable to experiment with shields of various designs, inasmuch as one that is suitable for one location would not be suitable in another place. When selecting material for radiant heat shields, care should be taken to avoid materials that oxidize readily when exposed to high temperatures.

The problem of controlling radiant heat should continue to be given attention. Studies could be made on the sustained reflectivity of various materials at prescribed conditions of temperature and dirt in order to determine the proper kind of radiant heat shield for use in various places.

Mr. Small's paper has opened the door to a large field of possibilities which justify further study on ways and means for controlling radiant heat found in various industries.

ALLEN D. BRANDT, Chief Industrial Hygiene Engineer, Bethlehem Steel Co. — Mr. Small's paper of necessity is a very brief sketch of the subject matter. This is very unfortunate because any of the three aspects of the subject which he summarized so well might well occupy an entire session if covered adequately. Because the control of radiant heat by effective shielding produces such spectacular results at such small cost, I should like to add a little to this phase of the subject.

Even though the principles involved in radiant heat shielding are simple and well known to all of us, I will risk reviewing them briefly because experience has shown that they frequently are overlooked or ignored. Almost all solid materials are essentially opaque to radiant heat. Even ordinary glass transmits only a small percentage of the radiant heat in the range of wave lengths normally encountered in industry. Therefore, any solid material if placed between the object to be protected and all surfaces of elevated temperatures will prevent the primary radiant heat from reaching the object in question. However, most materials absorb most of this radiant heat, reflecting only little, and thereby become heated themselves. They then become secondary sources of radiation and heat the object which is being shielded. Thus, much of the good done by cutting off the

primary source of radiation is lost by virtue of the fact that the shield becomes heated and in turn heats the object in question by radiation. Obviously, then, the best shield is one made of a material that reflects the radiant heat to the primary source and does not become heated itself. As pointed out by Mr. Small, there are several readily available materials which are good radiant heat reflectors.

So much for the first consideration in radiant heat control. The second consideration is that of keeping the amount of heat radiated by a shield to a minimum. The amount of heat radiated by a surface at an elevated temperature is a function of the temperature and of the radiating ability or emissivity of the surface. Obviously, then, in addition to keeping the temperature of the shield as low as practicable, the shield should be made of a material having a very low coefficient of emissivity. Many materials approach a "black body" insofar as radiant energy is concerned; that is, they absorb almost 100 percent of the incident heat and emit at a similarly high rate. By using a shield with a high coefficient of reflectivity on the side toward the source of heat and a low coefficient of emissivity on the side toward the object being protected, a double-barreled effect is accomplished — with the result that almost none of the radiant heat from the primary source reaches the object in question. Aluminum, for example, has a reflectivity coefficient of about 0.95, so that the temperature of an aluminum shield not in physical contact with a hot surface will rise only relatively few degrees above room temperature, and in addition, it has an emissivity coefficient of only about 0.05, with the result that almost no heat is being emitted or radiated by it. Because of its unusual characteristics in this respect, its availability, its convenience in handling, and its relatively low cost, aluminum is a singularly good choice for radiation shielding where interference with vision is of no concern. For windows or places where vision is important, special glass with unusually high reflective ability is now available.

It is important that the terms "reflectivity" and "emissivity" and the significance of them be appreciated fully if heat shielding is to be of most value. Also, it must be recognized that shielding is spectacularly effective only against radiant heat. If the problem is one of heating by convection, radiant heat shielding is of little (if any) value.

A few suggestions may be helpful in indicating where and how radiant heat shielding should and should not be used:

1) Radiant heat travels in straight lines in all directions from any hot surface, not only normal to the surface. Therefore, the shields must intercept all straight lines between the object to be protected and the hot surfaces.

2) Do not have physical contact between the shield and the hot body if it can be avoided. If there is physical contact, the shield is heated by conduction and only one of the two available "barrels" is operative, namely, the low emissivity. In addition, the ventilation between the hot surface and the shield is reduced or eliminated, with the result that convectional cooling of the shield is lost. Also, the hot body surface may increase sufficiently to cause rapid deterioration.

3) Do not forget that a good shield is highly reflective. For this reason, shields installed to eliminate one condition may create another. For example, if shielding is installed near to and along a motor room wall to reduce the heat load on the wall caused by hot metal stored or handled nearby, the radiant heat load on the opposite side of the hot metal is increased by the reflection from the heat shield.

4) Never install shields in such manner as to interfere with the natural ventilation through the area. To do so might create a worse condition even if the radiant heat load is reduced because the heat from convection will increase.

5) Radiation shielding is effective not only in increasing worker comfort, but also in increasing the life of motors, and other electrical equipment, and in reducing the heat load on certain air conditioned crane cabs.

We have used both aluminum shielding and reflective glass on mill pulpits with excellent results. The use of this special glass is of recent origin but aluminum has been in service several years on crane cabs and at several very hot operations as well as at the mill pulpits. The results are uniformly good in all instances where the heat load is primarily one of radiation.

A few examples will illustrate typical accomplishments.

By coincidence, a study was made of inside surface temperatures in a pulpit at a 54 in. mill when aluminum had been installed in part. The pulpit straddles the conveyor between the soaking pits and the rolls. At the time of this study, aluminum had been installed beneath the entire floor of the pulpit and up the side toward the rolls to the observation windows, a distance of about 36 in. from the floor. The observation windows were thick, shock-resistant glass which terminated about 12 in. below the roof. The inside surface temperature of the roof was 95 to 105 F; of the floor, 95 to 100 F; of the wall toward the rolls beneath the windows, 85 to 90 F, and above the windows 140 F. This provides two excellent points of comparison. The inside surface temperature of the roof which receives no primary radiant heat was a trifle higher than the floor beneath which ingots were passing regularly enroute to the rolls. The metal wall beneath the windows on the side toward the rolls which was protected by aluminum was 50 to 55 F lower in temperature than that on the same side of the pulpit but above the windows and unprotected. What this means in terms of heat exchange is that the unprotected wall was radiating heat at the rate of about 56 Btu per hr per sq ft toward the occupants, while if the walls had all been at the temperature of the shielded wall, the occupants would have radiated heat at the rate of about 8 Btu per hr per sq ft toward the pulpit walls.

In another instance, the installation of aluminum beneath the motor of a 48 in. shear crane improved the life of the motor a great deal. Before the installation of the aluminum, the motor was replaced on the average of once every six weeks. Since the installation, it has gone two years without replacement.

Since the bulk of the heat load at many hot operations in the steel industry is produced by radiation, appropriate shielding provides a singularly effective and economical method of protecting men and machines from exposure to unnecessary heat loads. Radiant heat shielding furnishes the engineering and operating personnel in steel plants with an excellent tool for decreasing maintenance costs of certain equipment and for removing some of the sag from the hot weather production curve.

GEORGE F. HAINES, JR., Industrial Hygiene Foundation, Mellon Institute — The scientific engineering thinking behind the development of ventilating and air conditioning systems

TABLE A—RELATIVE CONTRIBUTIONS of radiation and convection to the total heat load imposed on man

Test location	Heat exchanges Radiation	Convection	Btu per hr total	Radiation, percent of total	Convection, percent of total
D4	2550	1030	4550	56	23
D6	2190	570	3710	59	15
D7	1360	640	2950	46	22
D10	2590	1010	4350	55	23
D12	1390	540	2880	48	19
D15	1775	570	3295	54	17
D16	3110	590	4650	67	13
A11	5480	315	4745	75	7
A12	1940	120	5010	84	4
A14	2630	110	5690	71	5
A15	1775	120	2845	62	4

TABLE B—REDUCTION IN RADIANT heat load by simple screening (single sheet of aluminum foil)

Test location	Heat exchange by radiation, Btu per hr Without screening	With screening	Percent reduction in radiation
D4	2550	840	67
D6	2190	740	66
D7	1360	470	65
D10	2590	950	60
D12	1390	535	62
D15	1775	735	59
D16	3110	780	75
A11	5480	1200	66
A12	1940	950	52
A14	2630	780	70
A15	1775	760	57

is very impressive, but the application of these systems to the control of industrial heat exposure leaves much to be desired. These systems too often neglect adequate consideration of the radiant heat, which is responsible for approximately two-thirds of the heat emanating from hot surfaces. It is absolutely necessary to distinguish between radiant heat and hot air because entirely different methods are required for their control. Hot air, we know, can be controlled by ventilation or air conditioning—radiant heat can only be controlled by screening or insulating.

Of all the uncomfortable heat exposures I have experienced in the steel and glass industries, I have seldom seen a case where radiant heat was not the major offender, yet thousands and thousands of dollars are spent year in and year out treating the hot air which usually accounts for less than one-third of the total heat load imposed on the man anyway. I have seen cases where it was obviously ridiculous to provide more general ventilation and so local mancoolers were improperly installed blowing 90—110 F air directly over the man at velocities as high as 1500 fpm; still the radiant heat, which was the major offender, continued to blaze on entirely uncontrolled.

Body heat balance is a physiological requirement for health, and the human body, like a physical body, lends itself to the analysis of this balance.

There are four environmental factors which influence the interchange of heat between the body and environment and they are: (1) the air temperature; (2) air velocity; (3) air humidity and (4) mean temperature of the solid surroundings. To properly evaluate an industrial heat exposure an ordinary mercury thermometer, shielded from the radiant heat, will measure the true air temperature; a variety of meters are available for measuring the air velocity; a sling or aspirating psychrometer will measure the humidity and a globe thermometer will measure the mean temperature of the surroundings. It is then possible to determine the relative contributions of radiation and convection to the total heat load imposed upon the man.

Table A presents such an evaluation made by the Industrial Hygiene Foundation of industrial heat exposures in the glass industry. From such an evaluation, an intelligent and practical heat control program can be planned.

To supplement this work, an experimental radiant heat screening program was carried out on these heat exposures. These results are shown in Table B. The radiation screens used were of the reflective type consisting of nothing more than aluminum foil tacked onto light wooden frames. The screens were then placed, wherever possible, between the man and the heat source and the improvement in environment measured.

A reduction of 50—75 per cent in the radiant heat load was effected by these simple and rather crude screens. To achieve an equivalent improvement by ventilation would have been impractical, requiring approximately a 30 F drop in air temperature.

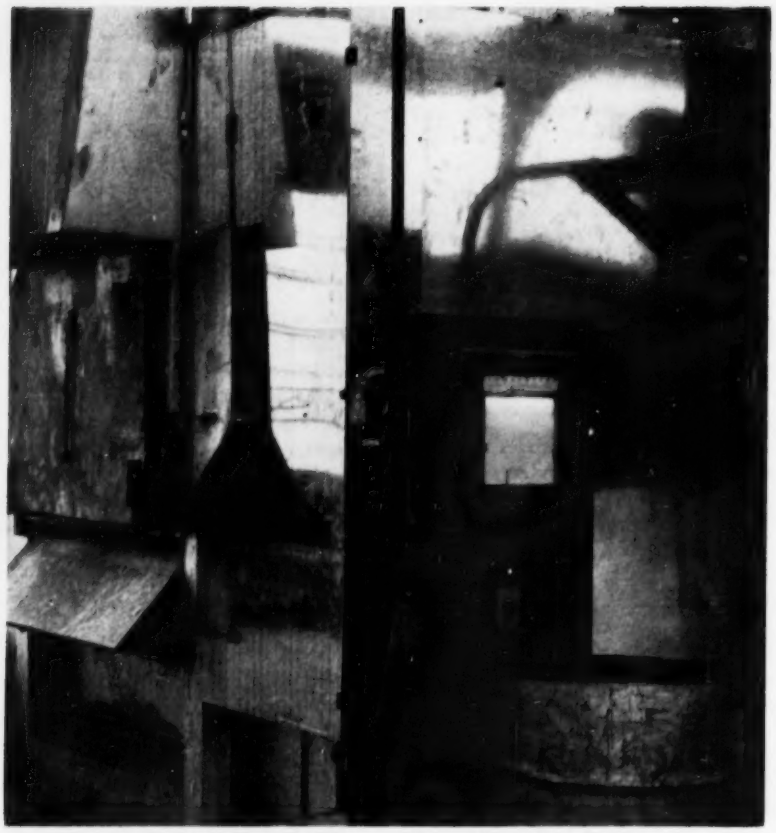
The importance of distinguishing between radiant heat and hot air cannot be overemphasized in the planning of a control program for industrial heat exposures.

JOHN H. CLARKE, Staff Engineer, Standard Oil Co. of Indiana — Because of the limited design information available on the subject, the Association of Iron and Steel Engineers is to be congratulated for scheduling this very fine paper on Heat Relief in Industries. It is a pleasure to be able to comment on the paper.

As a member of the Technical Advisory Committee on Industrial Ventilation of the American Society of Heating and Ventilating Engineers, as are Mr. Small and Dr. Brandt, I am keenly interested in the subject at hand. Spot cooling is one of many studies being sponsored by our committee, and it is our hope that the new calorimeter room which was recently completed at the ASHVE's laboratories may be made available in the not too distant future for extending the known information on this subject. Practically all of the research information available at present on spot cooling is the result of projects carried on for the Navy Department during the last war.

Mr. Small's data on the value of radiant shields are very impressive. With proper consideration, most of us can find applications where shielding would materially improve the working conditions. For instance, in a blacksmith shop application, shields were placed around the heating-up furnaces. This not only resulted in remarkably improved working conditions, but also improved the operation of the canopy hoods over the furnaces with respect to the removal of heat and fumes. Any other means of dissipating heat in the space would have been a failure.

The question of heat shielding brings up another item which could be explored with very beneficial results. That is the matter of clothing. A tremendous amount of research has been done on this subject (again, largely the result of projects for the armed services) and this knowledge can be applied to the problem of workers in hot industries. Properly selected clothing would increase the body heat loss by convection and evaporation and would reduce the radiant heat load to the body. Additional relief may be provided in excessively hot working areas by placing a wet towel around the shoulders.



RADIATION SHIELDS in place on furnace buckstays

as suggested by Dr. L. H. Newburgh of the University of Michigan. I tried wearing a wet, open weave sun hat on several occasions and found the relief to be well worth the trying. When Mr. Small's company can spin aluminum as Corning does glass or DuPont does nylon, perhaps we can solve this problem with aluminum suits.

Mr. Small's data on spot cooling are also very informative, although I believe that evaporative cooling should be used with caution and only in applications for which it is best suited. The use of mancooler fans, in my opinion, should actually be discouraged because there are very few places where the ambient heat level is low enough to permit any benefit from them because they simply stir up air that is at ambient temperature. The advantage of a duct system is that it can bring the air to the worker, each worker if desired, at little increase over the outdoor temperature, (2 to 5 deg maximum) and at velocities that are of value in removing heat. While roof supply fans, discharging downward, are better than the mancooler fans, they suffer from the lack of a duct distribution system and should be used only where it can be determined that they will be of appreciable value.

Spot cooling with outside air is very beneficial even at high ambient levels of temperature and radiation, as is evidenced by the thousands of applications providing tolerable working conditions in the ships of the Navy, Army, Coast Guard and Merchant Marine. There are many other such installations giving very gratifying results ashore. It is true that there is a penalty for cooling the body by the evaporation of sweat but the dehydration effect can be, and is, counteracted to some extent by the use of water and salt tablets. Outside air at low relative humidity and high velocity can remove about four times as much heat or more by evaporation from the skin as an evaporatively cooled system would remove by convection. Actually, if the radiation load is high or the activity considerable, the body will be in the zone of evaporative cooling in either case, and sweating will occur.

Obviously, an evaporatively cooled system will be of greater value at high radiant and high temperature conditions and will have a higher plateau of effectiveness at which it can maintain tolerable working conditions. Consequently, the application of evaporatively cooled spot cooling installations in the metals industries is certainly a good one. But such systems cannot be used with success in industries where the humidity is high, such as tire molding rooms and laundries. There is also a penalty on the human organism for working in highly humid atmospheres, and even if the ratio of outside to evaporatively cooled air is kept to 20 percent, as recommended by Mr. Small, trouble would be encountered. Also, in multi-story buildings, or single story buildings of low ceiling height and where there is a high worker population, the spot cooling air may need to be 100 percent of the air moved through the building.

Mr. Small has mentioned some of the drawbacks to evaporative cooling. It should also be noted that the resultant high humidity will cause rusting, which is particularly undesirable where there are precision instruments or machinery in the area. One plant which I visited had so much difficulty with icicles forming in the winter from the exhaust air discharges and window condensation, as a result of the high humidity maintained in their plant, that the street in front of the building had to be roped off for the safety of pedestrians. Further, the maintenance of these systems is high and this should never be overlooked when considering such systems.

There is another item to be noted with regard to evaporative cooling. Any installation of this sort will fail if it is provided on the basis of general ventilation unless the internal building load is so small that the system can actually lower the inside air temperature appreciably when the outside air temperature is at its summer maximum. This is seldom possible. Air changes and temperature rise are meaningless in working areas of high dry bulb and radiant temperature unless accompanied by adequate air movement, and the 300 fpm quoted by Mr. Small is certainly the minimum.

Mr. Small has mentioned the use of louvered outlets to obtain direc-

tion of the air to the worker. Such direction and volume control are essential, and can also be obtained by means of flexible hose, slot outlets, (provided with a slipjoint if desired to change the direction of discharge), punkah louvers (a ball with a cylindrical hole through the axis, fitted into a socket plenum), or by the Navy type "E" directional outlets. I prefer the latter in my work.

In selecting the type and size of outlets, it should be kept in mind that small nozzles and slot outlets have high induction ratios and consequently lose their effectiveness in a short distance because of decrease in velocity and increase in temperature. The advisability of large outlets is indicated by the large 15,000 cfm outlets which Mr. Small mentioned as being used for their Lafayette remelting building. At the 2000 fpm discharge velocity quoted, this would be equivalent to 36 in. diameter outlets. The large size of the outlet was undoubtedly a great contributing factor in its success. In my own design, I usually use 12 or 14 in. directional outlets located as close as possible to the worker, or a minimum of 4 to 6 ft.

The practice of the Navy Department for installations aboard their ships may be of interest. The Navy specifications require that 2000 cfm per man be provided at each operating station at velocities of 2500 to 3500 fpm, through type "E" outlets, (directional outlets with volume dampers). The outlets are required to be located 3 to 5 ft from the watchstander and to be so arranged as to make it possible to blow the air on the watchstander's torso. Laboratory tests made by the Navy at the ASHVE laboratories indicated that the subjects did not object much or show unusual reaction to 76 and 88 F air jets at velocities of 1000 to 2000 fpm during a 4 hr period. At velocities of 3000 fpm, and more particularly at 5000 fpm, the subjects became very much annoyed or distressed as time passed and would step out of the air blast occasionally into the hotter air surrounding this blast.

The author has mentioned another item particularly deserving of comment and that is regarding the use of high duct velocities. High duct velocities will not only hold down temperature pick-up but will also permit a substantial saving in the cost of the installation. Good duct design in keeping with the high velocities is essential. It may be of interest to know that there are numerous high velocity supply air ventilation systems operating with complete success in offices, department stores and industrial buildings. These velocities are as high as 4000 fpm for the office and department store buildings and as high as 6000 fpm for industrial buildings.

Whatever system or design is used, it is essential that it be designed properly for treatment *at the source of the trouble*, as indicated by Mr. Small, either by shielding, natural exhaust (if satisfactory), mechanical exhaust or spot cooling. The system must also be installed correctly (including balancing and putting the system in proper working order) and must be maintained properly at all times. It would be helpful to the workmen to explain how the system is supposed to work, and to provide them with adequate operating instructions.

BARTLETT R. SMALL — The admonition by Mr. Clarke to guard against causing high room relative humidities as a result of evaporative cooling is important. As an illustration, when motor rooms or engine rooms are shut down, the evaporative cooling should immediately be stopped, because 70 percent relative humidity could soon develop.

But the majority of installations in heavy industry serve small areas and usually produce only one to four air changes per hour of washed air in terms of total cubical contents. In fact, with the so-called split system suggested, the ratio of raw outside air to washed air would be in the order of two or five to one, with the general humidity increase hardly perceptible when the mill is in operation.

The question is frequently raised, as Mr. Clarke suggests, whether prevailing high humidities caused by bodies of water and valleys will nullify the advantages of evaporative cooling. This would be true if the temperature in the mill is as low as that outdoors. But a condition of abnormal heat is the problem at hand and the 10 to 20 deg temperature elevation produces a 20 to 30 percent reduction in relative humidity, so there is considerable leeway to receive moist air. In fact, one employee remarked that the moist air supply was just what was needed because of the dry heat.

Mr. Enlind points out the need of sustained reflectivity for radiation shields, realizing that fumes and the condensation of vapors with attendant dust adherence that can produce a build-up of successive layers will reduce the value of one or both faces. However, demountable sheets are easy to replace at one or two year intervals, if necessary, and the scrap value is excellent. Fortunately, common types of airborne dust deposits on a reflective sheet in a vertical position have been found to generally cause only negligible harm in the infrared range of wave lengths. The eye may be a good judge in appraising the reflectivity of a surface for visible light, but cannot evaluate the infrared radiation characteristics.

CHICAGO BUILDING TO USE RIVER WATER FOR CONDENSING

THIRTY-FOUR HUNDRED TONS of centrifugal refrigeration will air condition the 41 story, $40 million building of the Prudential Insurance Co. of America now under construction in Chicago at Randolph St. just east of Michigan Ave. Estimated cost of the air conditioning installation, which will circulate 1 million cfm of air, is $3½ million.

Water from the Chicago river, about three blocks away, will be used for condensing. Other Chicago buildings nearer the river have used the same scheme, but the Prudential building will be the first to convey the water such a distance for condensing purposes.

Through a 30 in. concrete pipe line 18 ft under a private right-of-way, 8500 gpm of water will be pumped to the building. Disposal of the condensing water will be through a 5 ft, 6 in. diameter concrete storm sewer now under construction. The sewer will serve other buildings in a six-square-block area and will also handle rainfall.

Naess & Murphy, Chicago, are the architects.

Navy's New Submarines

. . . . are air conditioned with a system that also saves the heat for use. Idea has possibilities in industry

By Howard S. Dewey

TO THE INDUSTRIAL plant exhausting heated air and replacing it — at a price — in the form of coal, oil or gas fuel, the economy found in heat transfer as practiced on one of the Navy's newest submarines should be of particular interest.

A simple explanation of the purpose of the system is this: It is a heat transfer system. In use on a submarine, unwanted excessive heat is extracted from those compartments where there is a constant heat source both summer and winter and transferred through the action of the "Freon" and chiller to those spaces which require heat via the "Freon" heater and hot water system.

In this manner — and contrary to the old system, which simply removed excessive heat and discharged it overboard through the salt water condenser — the heat is used elsewhere.

Air conditioning and heating the first submarines to be built since World War II [six, starting with the U.S.S. Tang (SS 563), recently commissioned] present something of a problem — a problem which is complicated by the snorkel tube down which all air for ventilation and the diesel engines enters the submarine. Also, it was desired to eliminate the old type d-c electric space heaters which required too much space and electricity. Cooling as originally done with "Freon-12" cooling coils had been satisfactory, but more cooling is needed. A more efficient means of both cooling and heating was thus desired without adding extensive and space-stealing piping and machinery.

Mr. Dewey has had several years of experience as an engineering officer in submarine service.

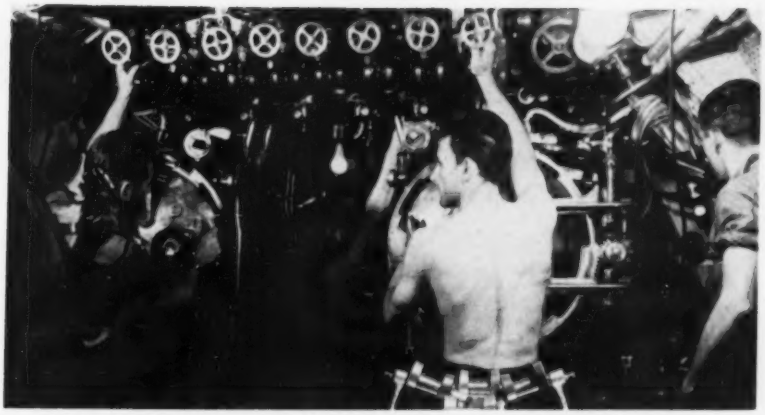
Air Conditioning Serves Dual Role

This has been done with an air conditioning system which serves a dual role. The compressor takes heat from its source (one or more cooling coils) which are absorbing heat and thus performing cooling or dehumidification duty, and raises its level just as in the cooling cycle. This heat is then transferred to fresh water heaters, via the refrigerant gas, and hence is retained for use inside the submarine.

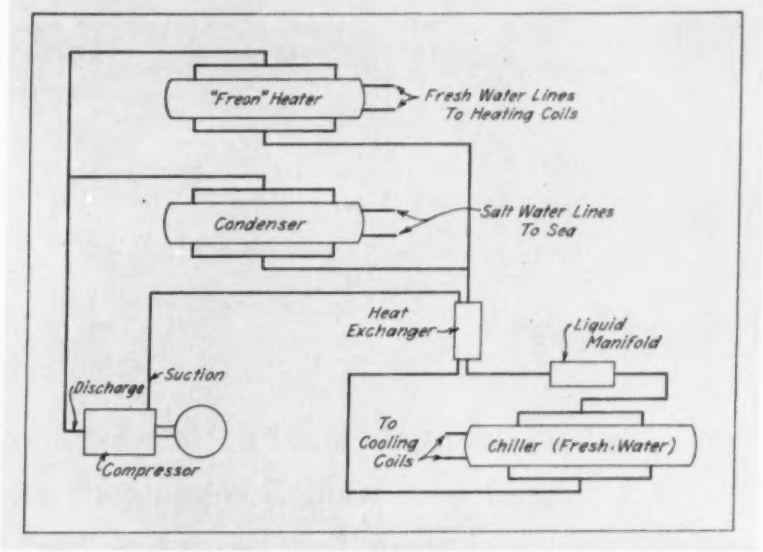
The system consists of a six cylinder (18 tons naval rating) compressor which discharges to either its heater (if on the heating cycle) and/or to the salt water condenser (for the cooling cycle). The liquid then goes to a receiver and then through a heat exchanger to the liquid manifold, a single cast block containing the expansion valve, stop valves, bypass valve and solenoid. Following the pressure drop, the liquid extracts heat from the fresh water chiller, evaporates and returns to the suction side of the compressor where the cycle is repeated. Regardless of whether the unit is performing heating, cooling or both, the refrigerant liquid is always routed through the chiller in order to obtain evaporation.

The equipment for heating the air consists primarily of a fresh water circulating system piped to deliver water from the "Freon" heater to the four heating coils in the submarine's living compartments and back to the "Freon" heaters by a hot water pump. The water is heated by means of the "Freon" discharge gas water heater.

Also indirectly involved with the heating equipment is the condenser water regulator valve and the pneumatic control system which completely and automatically controls the amount and the distribution of heating and cooling being performed.



THE NEED FOR air conditioning is indicated in this interior view of another type of submarine. (Official Navy photo)



NEW SUBMARINE AIR CONDITIONING system plays a dual role, conserving heat removed from some compartments for heating other spaces, as described in the text

In operation, when heat is desired the compressor discharge pressure is increased from approximately 125 psig to approximately 136 psig. The condensing temperature at the higher pressure is higher than at the lower pressure and due to the change in compression ratio an increased quantity of heat is available. The compressor of course is continuing to take its suction from the chiller, for cooling elsewhere or for dehumidification.

This change in discharge pressure is accomplished by reducing the flow of water through the condenser. The flow of water is controlled by means of a water regulating valve and the operation of this valve is controlled by the pneumatic control system. The valve also acts as an ordinary water regulating valve to maintain a constant condensing pressure at a required setting regardless of water temperature.

(In a case where air coolers are used there would or could be a damper control or a control of the ventilating blower.)

The hot water pump is put into operation, circulating fresh water through the discharge gas water heater and through the heating coils as required. The fresh water of the heating system becomes the condensing medium for the "Freon" system during the heating cycle.

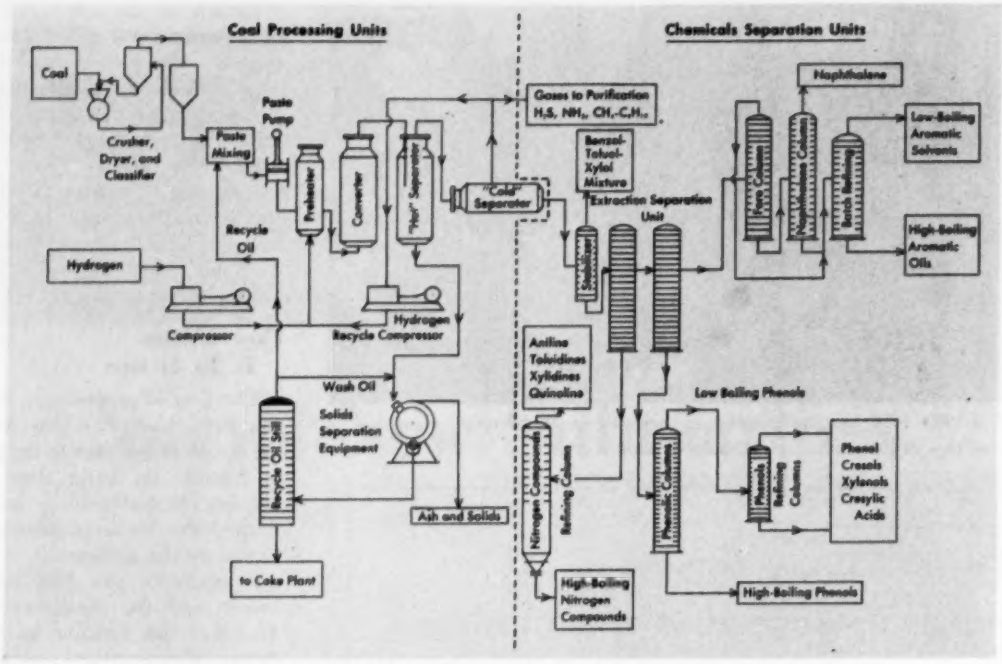
The heat from the "Freon" is transferred to the fresh water of the hot water circulating system and is thus retained inside the vessel instead of being discharged overboard by means of the salt water system as is done when cooling alone is required. The heated water is circulated to the four heating coils. The discharge gas water heater functions both as condenser and water heater; the liquid "Freon" drains from the water heater to the liquid receiver of the system, from there it flows through the liquid manifold to the water chiller and back to the compressor to repeat the cycle.

Flow of Gas Is To Heater

The flow of compressor discharge gas when heating is required is to the heater rather than to the condenser because the main flow of condensing (heat absorbing) medium is through the discharge gas water heater and not the condenser. Compressor discharge gas fills the water heater and the condenser. The discharge gas remains in the condenser in an equalized condition with little or no flow of gas or heat to the condenser because there is no appreciable flow of condensing medium through it. The condensing medium in the "Freon" condenser is salt water and the flow of this water is reduced to a minimum by means of the pneumatic control system and the water regulating valve when heating is required.

Cooling alone is much simpler. It is briefly described to fill in the picture. When cooling is required, the cooling coils absorb heat from the air within the ship to lower the dry bulb temperature and to condense moisture, lowering the wet bulb temperature.

The chilled water circulated by pumps in turn gives up its heat to the "Freon" inside the water chiller. The heat-laden "Freon" returns through the refrigerant system suction lines to the compressor. The compressor raises the temperature level of the "Freon" so that the heat can be transferred to the condensing medium, the salt water condenser or to the heater if heating is also required. The "Freon" gas is liquefied during this process. The flow of compressor discharge gas if on the cooling cycle alone will be to the condenser rather than to the discharge gas water heater because the main flow of condensing medium is through the condenser and not the water heater.



THIS SIMPLIFIED FLOW SHEET shows chemicals production by coal hydrogenation at a Carbide and Carbon Chemicals plant

The Fuel Situation

HPAC's annual round-up of where we stand now, what developments are underway, how the future looks

By Kalman Steiner

SIGNIFICANT developments in our fuel situation last year included increased mechanization of coal mining, charring of coal and lignite, Canadian crude, the tidelands oil resources, bulk liquid fuel storage, and nuclear energy. These were commented upon in the January HPAC.

Progress in Synthetic Fuels

During the year 1952 the Secretary of the Interior made public the report of Ebasco Services, Inc., the consulting firm that had been retained to make an independent audit of manufacturing costs in a proposed 30,000 bbl per day synthetic liquid fuels plant, based on methods of coal hydrogenation developed in the demonstration plants operated by the Bureau of Mines for some years in Missouri. "Ebasco's evaluation included a detailed study of two important items of construction costs; an extensive analysis of six major operating cost factors; a comprehensive study of the marketability of chemical products; and an investigation of company-financed housing requirements." [from *Synthetic Liquid Fuels*, Annual Report of the Secretary of the Interior for 1951, issued July 1952. Report of Investigations 4865.]

The report indicates that the Ebasco studies supported many of the important cost factors previously estimated by the bureau. The bureau's original estimate had been an annual production cost of $53,199,500 including depreciation; Ebasco modification shows $58,753,500. The annual value of fuels and chemicals, including gasoline at 11c per gal, had been originally estimated by the bureau at $79,859,000; as modified after the Ebasco findings it is $76,180,700. For rate of return on equity capital the first estimate had been 6.98 percent; modified, it is 3.59 percent.

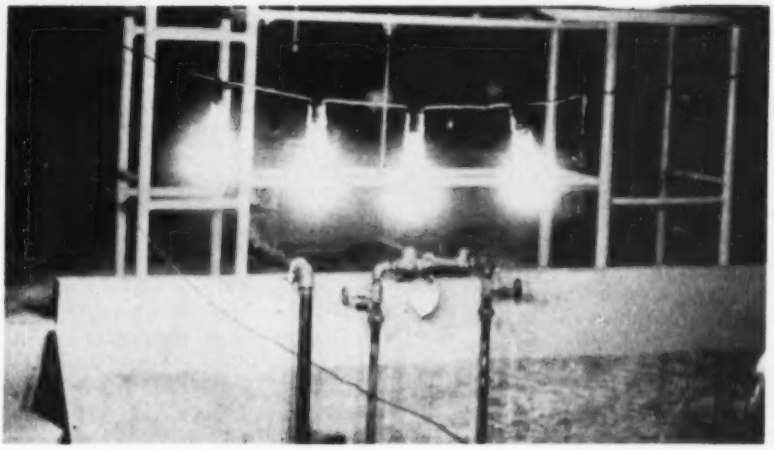
The National Petroleum Council took issue with the conclusion that

Mr. Steiner, of C. Hoffberger Co., Baltimore, is a member of HPAC's board of consulting and contributing editors. He has written widely on fuels and fuel burners from a background of much practical experience and careful study. In recent years, he has summarized the fuel situation in each January issue of HPAC. This article supplements last month's.

Ebasco supported the bureau. NPC interprets the figure to show that the net cost of gasoline, after allowing for financial charges and byproduct revenue, would be 28.1c per gal. However, NPC had itself made an original estimate of production costs at 41.4c per gal.; so Ebasco, it concedes, strikes a compromise figure.

The National Security Resources Board took no official position regarding synthetics, but recommended to the President, as a result of release of the Paley report, the appointment of a special group to study synthetic fuel possibilities. Dr. Robert E. Wilson, board chairman of the Standard Oil Co. (Indiana) commented that "since it will be much more than a decade before synthetic fuels from any of these routes (hydrogenation, Fischer-Tropsch, shale) can really compete with petroleum, the interim should obviously be spent on pilot plant and other small scale development work, aimed at improvement of the processes for converting both coal and shale. Large scale plants probably would be obsolete before they were completed, and would cost many times as much as an intelligently planned research program which would give information of more real value." On the other hand, Reese H. Taylor, president of the Union Oil Co. of California, stated at a meeting of the Texas Mid-Continent Oil and Gas Association that production of shale oil on a commercial basis is closer to realization than many people appreciate, and that any substantial increase in cost of producing petroleum or any further economies that might be developed in oil shale processing would bring the two raw materials pretty well in line.

During 1952 and late 1951, a series of patents were granted by the U. S. Patent Office covering an integrated gasification electro-chemical system, embodying a process for converting coal directly into electricity without necessity for boiler or generator. The fuel is reacted with steam, as in older gasification systems, to produce carbon monoxide and hydrogen. These gases are introduced into gas cells at high temperature, somewhat resembling storage batteries, where electro-chemical action results in oxidation of the gases and the concurrent production of electric energy. The process is still in early development stages, with no immediate outlook for exploitation.



FIRST KNOWN USE OF electric power from atomic energy was represented December 20, 1951, by these light bulbs at the AEC's National Reactor Testing station in Idaho, where the experimental breeder reactor was operated by the Argonne National Laboratory

Announcement was made at the 1952 annual meeting of the American Society of Mechanical Engineers of a new process developed in Germany for gasifying pulverized coal, to produce a fuel gas not unlike coke oven gas. Pulverized coal is gasified in a vortex or cyclone chamber. The system works at high temperature, making possible liquid slag removal, facilitating conversion of low grade coals, lignites and chars The process is a continuous one, with recirculation of unconsumed fuel, involving the use of a preheated air stream at 1100 F. It is said that this new process is a valuable addition to the existing but somewhat strained coke and gas producing capacity of Germany, helping to meet a rapidly increasing demand for fuel gas.

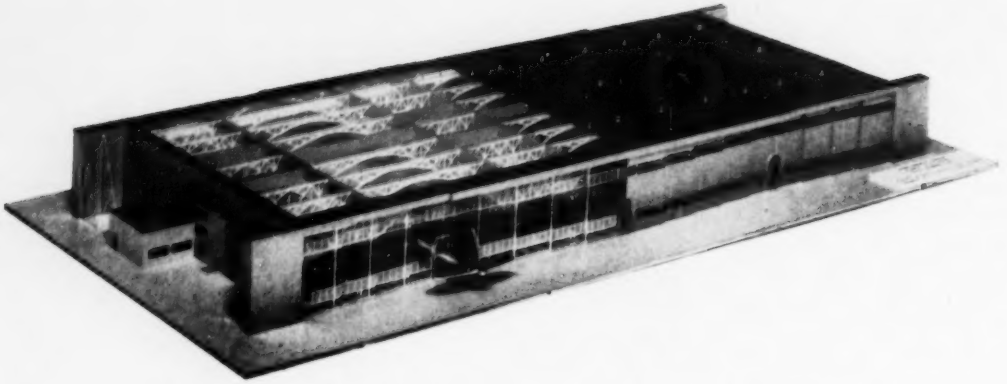
Coal As a Chemical Raw Material

The use of coal as a chemical raw material rather than as a fuel increases rapidly. According to Bituminous Coal Research, Inc., this country is currently consuming about 100 million tons of coal annually for production of coal chemicals, principally in chemical recovery coke ovens. It is estimated that by 1975, if the proper technology continues to develop, we will use 129 million tons annually for coke and chemical byproducts, 135 million tons in making chemicals and liquid fuels by hydrogenation, 155 million tons for chemicals and fuel by the Fischer-Tropsch process, over 5 million tons for making synthetic ammonia, and about 4 million tons for synthetic methanol (wood alcohol).

The first of these coal-to-chemical plants is now operated by Carbide and Carbon Chemicals Co. at Institute, W. Va. It is called a pilot plant; it cost $11 million to erect and can process 300 tons of coal daily. If the plant comes up to expectations, the company expects to erect a series, up to possibly five, each to cost about $100 million and to have capacity of 3000 tons daily per plant. This pilot plant employs hydrogenation to convert coal to chemicals; the process can be made to yield gasoline, but at present the intermediate chemicals are more valuable and so the principal products today are such materials as phenols, benzene, toluene, cresols and many other organic chemicals.

Much coal ultimately may be utilized without seeing the light of day, by undergoing gasification while still in the mine. The Bureau of Mines work at Gorgas, Ala., continues to establish the success of various new developments of underground linking of seams and gasification of the coal.

[The author makes grateful acknowledgement of assistance in the preparation and review of this article by Dr. W. C. Schroeder and associates at the Bureau of Mines, and to others who have extended invaluable aid.]



ONE OF THE THREE basic types of maintenance hangars designed for the Air Force

Heating Airplane Hangars

Staff engineers of the Kuljian Corp. — architects and engineers — describe modifications in the basic design of the Air Force's new maintenance hangars and how the changes affect heating, other utilities

CERTAIN MODIFICATIONS made in the basic design of the Air Force's new maintenance hangars, together with a study of local conditions, have led to important changes in the design of the various utilities for these structures. The methods of heating these hangars, as well as other features of them, were described in some detail in the June 1952 HPAC.

The modification of the basic design which was chiefly responsible for changes in all the utilities was the elimination of the escape tunnel. This escape tunnel was replaced by a fireproofed stair tower leading from each shop to the main hangar roof, with reliance upon the outside shop towers as the avenues of escape from the building itself. It is expected that this method will provide an effective (even though less convenient) escape from danger areas at a very substantial saving in cost.

The adoption of this new feature, however, cancelled the access tunnel for all utilities. Water lines for domestic use and fire protection are now located generally along the center-line of the hangar and under the slab. All service branches are located within the shop areas, where the floor slabs are of normal thickness.

Sprinkler system control valves have been reduced in number by combining adjacent systems under more liberalized rulings by the various agencies, and grouped inside the shop buildings instead of along the outside walls. This was accomplished with no loss in effective floor space by locating the group along the elevator wall. Road boxes are used to protect and provide access to domestic water supply branch valves, which are under the shop floor slabs.

Elimination of Tunnel Affects Heating Design

The most serious problem of distribution that had to be solved was for heating. The cancelling of the tunnel eliminated completely all access for valving the radiant heating system; maintenance of steam, condensate and hot water lines; and what was originally a simple solution of thermal expansion conditions. All parties concerned were reluctant to consider the use of underground steam and hot water piping, either through trenches or conduit, since either method would involve isolated manholes and provide traps for explosive gases. As the lesser of the two evils, the Air Force relaxed its prohibition against overhead heating pipes to permit the use of overhead mains.

Further examination disclosed that although overhead steam and condensate lines were practical, portions of the condensate would have to be pumped from each shop. Furthermore, the radiant heating system supply and return mains would have to be looped over the shops, thus resulting in many operating inconveniences.

Generally, each shop contained an elevator, and the elimination of one stair tower meant that there would be an isolated space between the ele-

vator shaft and the corner of the building. Elimination of the tunnel necessitated the relocation of the elevator pump from the tunnel level to the first floor. This isolated space is now used as a utility room, enclosing the elevator pump, condensate receiver and pump set, and zone radiant heating converter and circulating pump. Thus, the total floor panel area is divided into zones surrounding each shop, and heat is distributed to the shops by the one medium, steam. Condensate from all heating units drains to the shop receivers and is pumped back to the boiler room, thereby eliminating several pipe lines, and the pump for handling 100 percent condensate including installation and wiring is not much higher in cost than would be the minimum sized unit to handle the condensate from modulated steam supply. For obvious reasons, the equipment for the shop adjacent to the boiler room was placed in the boiler room, and the condensate returned directly to the boiler room pumping unit.

Flexibility Provided for Local Choice

Subsequent experience in areas where hangars are actually being installed proved that the advantages of radiant heating could not be fully utilized. To meet all these conditions, the government has provided a degree of flexibility in the local users' choice of design. For the plus 20 deg temperature zone, radiant heating has been eliminated. For the zero zone, two designs are available — 100 percent air heating units, or a combination of air heating units and radiant heat. The minus 20 deg zone remains as originally designed. Here again, the zone utility room system proves its worth, since at all times each shop handles the same amount of heat per temperature zone regardless of the heating combination.

Where no radiant heat is installed, the anti-icing equipment is also eliminated. For the other type, the converters, pumps and piping were redesigned to consolidate all equipment within the boiler house, thereby freeing the lean-to utility house of all heating equipment.

No changes were made in the storm drainage system, except that floor slabs were rearranged so that highway finishing machines could be used instead of the hand finishing formerly required, and the need for tunnel sump pumps is automatically eliminated.

It was found that generally the hangars are to be located along the borders of airfields and projecting somewhat like a pier into the field area. Storm water on the end toward the field can generally be carried away through the field drainage system. However, since there is usually no sanitary sewerage on the field side, the original split system (intended to keep the inverts as high as possible) would actually result in a lower invert in the necessary return loop. The two laterals were therefore combined into one, and the discharge is now always to the end of the hangar nearer the sewer main.

So many of the local users did not require full shop space that additional master plans were prepared which provided for one story shops initially, but with arrangements for future expansion to the full three stories. This did not affect the utilities to any great extent, with the exception that air heating units and electrical equipment normally located on the third floor shop roofs are, in these cases, relocated on the first floor shop roofs.

In general, the review of the project has resulted in a design which is highly flexible and still retains a basic uniformity throughout the various sites, regardless of the users' local modifications.

Changes Made in Electrical System

Changes were made in the electrical system of the hangars in order to save copper and as a result of modifications in requirements by the Air Corps.

Electrical power is supplied to each hangar at the primary distribution voltage. The incoming primary is protected by an automatic oil circuit breaker which is located in the boiler house or utility room. A primary cable is carried overhead in steel conduit from this oil circuit breaker to a substation located on the roof of each shop tower. Each substation consists of a 225 kva, three phase, dry type transformer with a secondary voltage of 240/416 volts grounded wye for power distribution, and a 150 kva, 3 phase, dry type transformer with a secondary voltage of 120/208 volts grounded wye for lighting distribution. Each transformer is provided with a three pole group operated primary disconnect switch, three current limiting primary power fuses, and a secondary air circuit breaker. The primary disconnect switch and secondary air circuit breaker are key interlocked to insure safe and proper sequence of operation.

Power at 240/416 volts is distributed from a fused distribution panelboard to the large motors and large power outlets. The small motors are fed in groups from circuit breaker panelboards which in turn are fed from the main fused panelboard.

Lighting at 120/208 volts is distributed from a fused distribution panelboard to the various circuit breaker lighting panels. The 100 amp outlets for portable lighting panels are supplied directly from the fused panelboard.

The power receptacles for supplying supplementary power were also changed. Three phase, four wire, 120/208 volts, 100 amp floor outlets interlocked with a magnetic contactor are located at convenient points. Wall outlets of the same size are also provided on the shop walls. However, these wall outlets are located above the 4 ft, 0 in. hazardous location zone and are, therefore, not interlocked with a contactor. These 120/208 volt outlets are for supplying power for portable lighting panels. Three phase, four wire, 240/416 volts, 100 amp floor outlets interlocked with a magnetic contactor are provided for portable frequency changer motor generator sets.

The electrically operated rolling doors were changed to 416 volts. The controls for these doors did not change.

The general lighting in the hangar has been changed. Single high bay lighting units suspended from the roof trusses and arches are used. Alternate units of 1500 watt incandescent and 400 watt mercury are used. Each unit is provided with a lowering disconnecting hanger so that they may be lowered to the floor for servicing. The average maintained intensity of illumination in the hangar is about 25 footcandles.

No changes were made in the fire alarm system, grounding system, shop lighting, or obstruction lights.

ANYTHING CAN HAPPEN

The Pipe Line That Led To the Court House

By C. T. Baker
Consulting Engineer

Poor piping layout for engine cooling water causes trouble

• Almost anything can happen when you're in the engineering or contracting (or sales) ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss the many practical problems that need solving — and ways to solve them. Mr. Baker dug into his files for this actual example of trouble which would never have occurred if a little commonsense had been used originally. The cost of maintaining the engine in service, before the piping system was revamped, was considerable.

SOME YEARS AGO, the owner of a natural gas electric power station that supplied electric service for several closely grouped industrial operations found it imperative to increase the capacity of the plant because of extended demands for power.

To provide the required station capacity, a 240 hp, natural gas engine driven, 165 kw, 80 percent power factor electric generator was installed. Both the engine and generator were of the best in design and construction.

Preliminary trial runs were made at part load, when the new unit was ready to go into service, and this was later increased to about 50 percent of full load. Overall performance at this rating was satisfactory. However, in subsequent operation, running at or near full load, trouble developed because of an inadequate water supply to the cylinder jackets. Eventually, this resulted in damage to pistons and piston rings. The best of lubricating oils failed to help much in holding the piston and liner wear to tolerable limits.

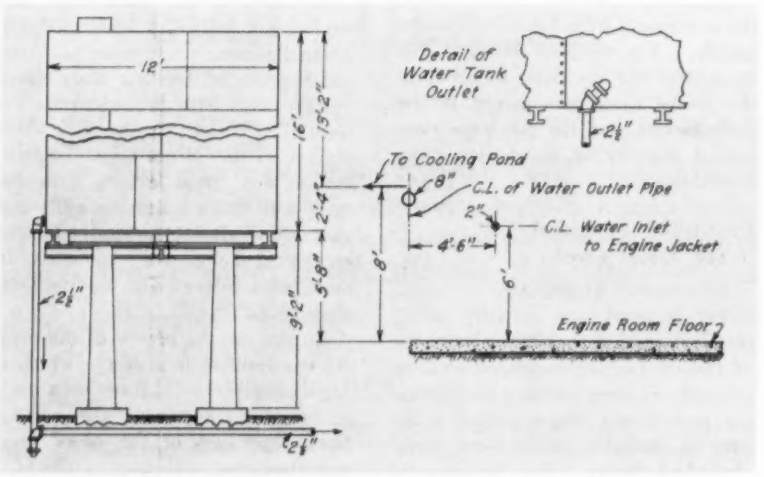


FIG. 1—BOTTOM OF TANK originally was only 5 ft, 8 in. above the floor

The unit was frequently off the line for periods of considerable length to permit replacement of worn and damaged parts — particularly exhaust valves — and performance was very unsatisfactory.

Water to the cylinder jackets was supplied from an elevated outdoor tank supported on concrete piers. The closed system of jacket cooling was not used — instead, raw water from the cylinders was piped to a spray pond located some distance away and several feet below the center line of the water outlet manifold. Only one spray nozzle was used for handling this overflow which, at full load, should have been 80 gpm.

After passing through this nozzle into the concrete storage basin, water was returned to the elevated tower by a motor driven centrifugal pump. Fig. 1 shows the storage tank elevation above ground, as it stood when the new unit was first placed in operation. Fig. 2 shows the engine, generator and piping layout in plan.

Originally, the bottom of this 16 ft high tank was only 5 ft, 8 in. above the floor. Fig. 1 also gives a very clear picture of the circuitous route of the supply line between the tank and the water inlet to the jackets.

Fig. 3 is an elevation of the inlet and outlet water piping inside the engine room. At times, a part of the water from the jackets was used in a nearby laundry (indicated at "A", Fig. 3). When the laundry was not in operation — nights and weekends

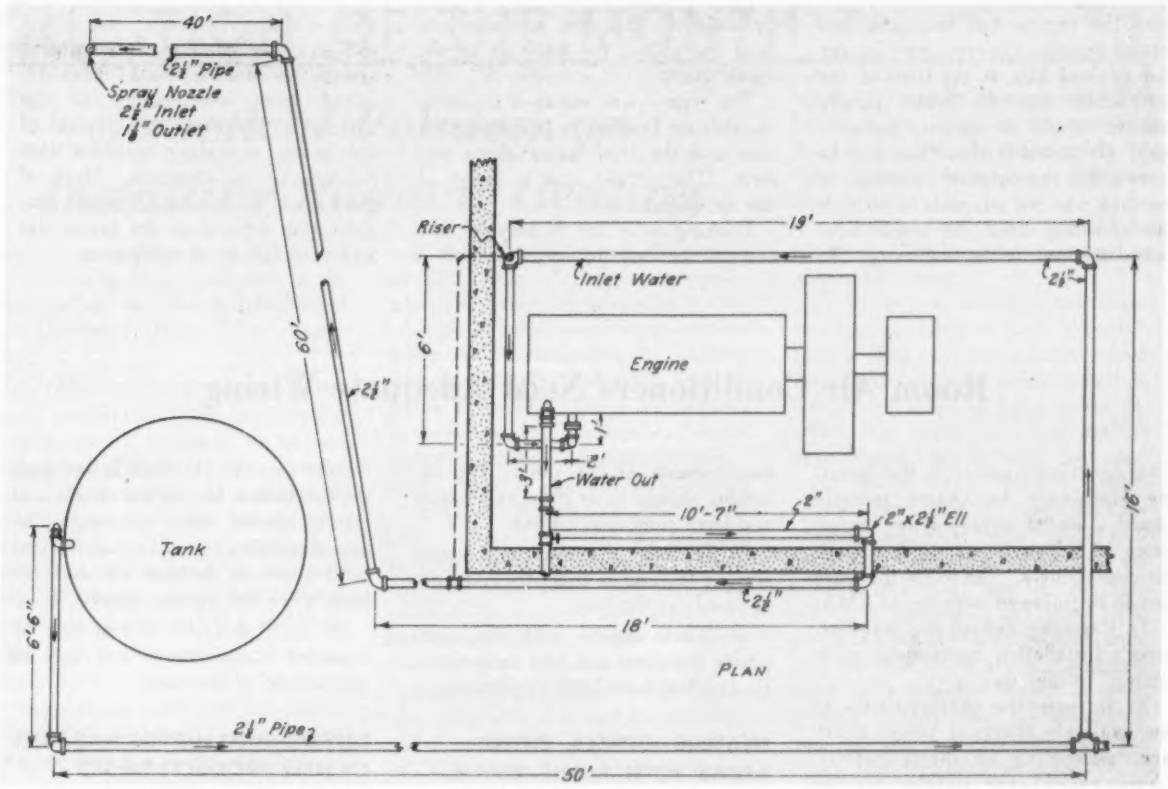


FIG. 2—COOLING WATER for the engine was supplied from tank by circuitous piping

— all water went to the spray pond. To reach the pond, it had to pass through about 10 ft of 2 in. pipe and fittings, as shown.

The tabulation reveals the amazing features of the piping layout.

Pipe diameter	Total length	No. of right angle el' ows	No. of 45° elbows	No. of valves
2½ in.	224 ft	15		1
2 in.	10 ft	1	2	1

Added to the friction of the pipe and fittings was, of course, the head, represented by the single spray nozzle which, with a flow of 80 gpm and 7 lb inlet pressure, amounted to slightly more than 16 ft. It is evident from the overall piping layout that its installers proceeded "without benefit of clergy" and with the confidence of ignorance to plan the cooling water piping system.

Raise Elevation of Tank

After a thorough check of the cooling results of the system, a new chief engineer raised the tank to the elevation shown in Fig. 4, which placed the bottom of the tank 23 ft, 8 in. above the engine room floor.

The supply line was shortened by re-routing it, as shown to the left of the elevation (Fig. 3). With the elimination of several feet of pipe and a few right angle elbows, the loss in head because of friction was greatly diminished, and the troubles from cylinder over-heating disappeared.

While these improvements were being made, the owner placed an order and received a large shipment of repair parts — exhaust valves, pistons, rings, etc. — which he stored for future need. When demand for payment was made, the owner refused, contending that his repair bills had been exorbitant ever

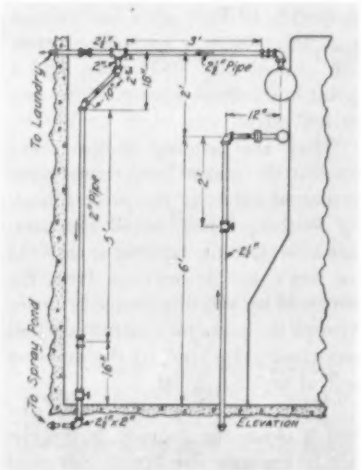


FIG. 3—PIPING IN THE ENGINE ROOM. Part of the jacket water at times was used in nearby laundry

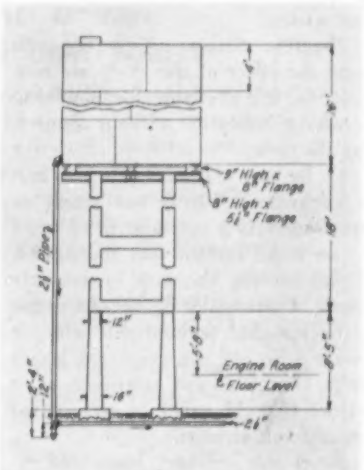


FIG. 4—AFTER THOROUGH CHECK of results, the tank was raised, as shown in this sketch

since the engine had been put into service because the erecting engineer had advised him at the time of the installation that the water supply selected would be entirely satisfactory. He stated further that, had he known that the original elevation of the tank was not adequate to provide the necessary head, he would have raised the tank in the beginning. The upshot was that the manufacturer sued the owner for the cost of the repair parts.

The writer was engaged to assist the defense lawyers in preparing the case and the trial lasted about two days. The verdict was in favor of the defendant.

Looking over the history of this case, it is easy to see that had a little commonsense been used in laying out the cooling water piping system no trouble would have resulted from over-heating of the cylinders. However, it is typical of too many operating troubles that come over the horizon. Most of them could be avoided if proper consideration were given the laying out and installation of equipment.

Room Air Conditioners Need Adequate Wiring

THE AIR Conditioning & Refrigerating Machinery Association recently issued a leaflet stressing the importance of adequate wiring for room air conditioners. The following rules should be followed, says the ACRMA:

1) Carefully follow the manufacturer's installation instructions as to wiring, fusing, etc.

2) Be sure the characteristics of the available electrical power (voltage, alternating or direct current, phase, cycles) are suitable for the particular room air conditioner being installed.

3) Check the power supply. For satisfactory operation, the voltage supplied to the unit should be within 10 percent of the name-plate voltage.

Voltage should be checked with a good voltmeter while the unit and all lights and appliances on the same circuit are operating. If the voltage is too high or too low, check over the power supply and the branch circuit wiring.

Phantom testers, which approximate the effect of the room air conditioner, are available for obtaining a voltage indication without connecting the unit.

4) Be sure the wiring to the unit is adequate. Wiring too small, or overloaded, is a potential fire hazard — so make certain that the branch circuit serving the unit is properly sized. Units under ¾ hp can usually be installed without difficulty on existing No. 14 gage circuits; larger units almost always require heavier wiring (No. 12 gage) or are applied on 230 volt circuits.

Never use ordinary household extension cords — the wire is too light. If an extension cord must be used, it should be of at least No. 14 gage wire or larger, depending upon the requirements of the unit. The extension should be as short as possible and have good connections.

5) Be sure the electrical circuit serving the unit is properly and safely fused for the job.

6) Work closely with the local power company and city authorities. Be familiar with local regulations.

HEATING OFFICES, OTHER AREAS WITH PLANT STEAM

PLANTS OPERATING on steam pressures of 100 lb or more can use the steam to heat offices and other areas economically by using a thermostatically controlled system, according to Carl E. Wigner, chief engineer of the Borden Co.'s Chestnut St. branch, Chicago, in a recent letter to the industrial division of Minneapolis-Honeywell, Philadelphia.

"The thermostatically controlled system," he said, "requires only three components. They are a low voltage room thermostat, a low voltage pressure control unit (0-15 psi), and a ½ in. low voltage spring return motorized valve.

"They are installed in this way: Connect the steam line, through the motorized valve, to the present heating system. Then install the pressure control unit, tapping it into the line anywhere downstream from the valve. Wire the thermostat in series through the pressure control unit and motorized valve, and set the pressure control unit for 2 psi.

"When the thermostat calls for heat it closes the contacts in the circuit to energize the pressure control and the motorized valve; the motorized valve opens at the command of the pressure control and maintains 2 psi steam through the radiator lines. As the demand for heat is satisfied, the thermostat breaks the circuit and the motorized valve returns to its closed position; it will remain closed until there is another demand for heat, when the process repeats."

He said that the system can be installed inexpensively and can be maintained at low cost.

DETERMINING HIDDEN HAZARDS OF NEW PRODUCTS URGED

THOROUGH INVESTIGATION of all new products by their manufacturers to determine whether or not there are hidden hazards to property and to the public was urged by John V. Grimaldi, director of the industrial division of the Association of Casualty and Surety Companies, who spoke at the annual meeting of the American Society of Mechanical Engineers. He said that "too often dangerous new products reach the market causing destruction to property, injuring the public or harming its health. Just as frequently, new products have damaged their manufacturing plants and surrounding buildings or have injuriously affected employees."

Pointing out that the policy of "buyer beware" has changed to one of "seller beware," Mr. Grimaldi said that "the question is not whether the manufacturer is right or wrong concerning the hazards of his product. He must know and be able to prove that his product is free from hidden hazards when any liability claims are made against him. Although a manufacturer is not yet required to produce an 'accident proof' product free of both latent and recognizable hazards, he is often called upon to defend such suits."

QUESTION OF THE MONTH

Practical Pointers on Installing Radiant Heating

THIS IS IN ANSWER to the questions on radiant heating, published in the Question of the Month columns of the December 1952 HPAC, page 109:

a) 165 F to 180 F average boiler water temperature has been found satisfactory on hundreds of radiant heated installations in the eastern part of the country. As a matter of fact, with most oil fired installations using No. 2 oil, it was found satisfactory to use a reset control and vary the boiler water temperature between the limits of 100 F to 145 F.

b) Pumps should be sized for at least a 20 F drop not only for proper temperature rise for the boiler but also for proper mixing action by three-way thermostatic valves. If the temperature drop is too small, mixing action will be sluggish and sensitivity of the instrument reduced. Some engineers use a 10 F temperature drop for floor coils to obtain a more uniform surface temperature. This, however, can easily be obtained by the proper spacing of pipes as well as the maintaining of low mean water temperatures—and not by a 10 F drop. If floor panels are designed for an average of 105 to 115 F mean water temperature, there should be no hot spots with 20 to 25 F water temperature drop.

Thermostatically controlled three-way valves are essential regardless of the boiler water temperature maintained; however, they should be carefully selected for the proper characteristics.

For example, with a boiler water of 200 F or higher and with the maximum desired flow temperature to radiant coils of, say, 120 to 125 F, it is best to introduce a preblender which will maintain supply water to the three-way valve at a temperature not exceeding 140 F. This is necessary to increase the sensitivity of the outdoor controlled three-way valve. If preblending is not provided, it will be necessary to keep the hot water port of the three-way valve closed through 90 percent of the range of outdoor temperatures in order to maintain a low enough blended water temperature; otherwise, overshooting or hunting will occur. This naturally will require a greater change in outdoor temperature to produce a corresponding change in water temperature than is normally expected.

c) It is unfortunate that while almost always strainers are installed in front of steam regulating valves, reducing valves, etc. they are often omitted on controls and pumps on hot water systems. This is mostly due to the misconception of the "closed system". While undoubtedly very little dirt will find its way into the system after it has been thoroughly cleaned, I have removed such items as rags, cords, gravel, screws, etc., either from strainer screens or from three-way valve bodies "after the system had been flushed." It has been our experience that continuous cleaning is desirable for at least a month after installation and yearly thereafter.

d) The best method of boiler piping (in my opinion) seems to be to provide a special boiler fitting which will assure that entrapped or liberated air in the boiler will find its way to the expansion tank. A liberal size boiler header or entrance pipe is helpful.

e) Compression tanks should be rated on EDR capacity and not on gallonage alone.

f) There are a number of books, treatises, pamphlets and manufacturer's data on the market which seem to be adequate to cover certain specialized fields of application for which they were intended, but we have found that a basis for complete design of a radiant heating system must take into consideration unheated and total mean radiant temperatures — which play an extremely important part in the heat output of panels — and must limit water temperatures to achieve comfort and low, even surface temperatures — especially for floor coils. It must further take into consideration the type of covering used for floors and the bury of pipes.

g) Boilers should be equipped with ASME rated safety relief valves based on Btu capacity and no relief valve should have more than 1,000,000 Btu per hr rated capacity, in my opinion. If boiler ratings are higher, as many relief valves as are necessary should be used.—T. ROBERT STEVENS, Manager, Engineering Dept., Sarcotherm Controls, Inc.

"HOW DO I CHOOSE BETWEEN 'PACKAGED' OR 'CONVENTIONAL' BOILERS?"

If you don't have the answer to a problem, chances are someone else does — or can be helpful on part of it. That's the purpose of HPAC's Question of the Month "idea exchange," where questions on heating, piping and air conditioning are asked and answered.

You are invited to contribute a question for publication, or an answer to a published question. . . . . Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Here's a question a number of engineers and contractors have asked recently:

"I know that both packaged boilers and conventional or 'built-up' boilers for heating industrial and other large buildings have their respective advantages and disadvantages. For a specific installation, either one or the other must be the correct choice.

"Informed comment on when and when not to use either type, with the reasons briefly given and with actual examples cited, would — I am sure — be of interest to many of HPAC's readers."

DATA SHEET

Depreciation Rates for Air Conditioning and Heating

BULLETIN "F" (revised January 1942) of the U. S. Treasury Department's bureau of internal revenue (for sale by the Superintendent of Documents, Washington 25, D. C., for 30 cents) contains information on income tax depreciation and obsolescence, estimated useful lives and depreciation rates. The figures are based on averages and are not prescribed for use in any particular case, as they are intended to be only a guide or starting point from which correct rates may be determined.

The following figures on the average useful life (in years) of several types of building equipment have been taken from this bulletin:

Air conditioning:	
Air conditioning systems—	
Large—over 20 tons	20
Medium—5 to 15 tons	15
Small—under 5 tons	10
Air washer. (*See* Dehumidifier.)	
Compressors—	
Refrigerating	20
Air for pneumatic controls	20
Condensers—	
Shell and tube	20
Double pipe	20
Evaporation	15
Coolers, water—tank and coil or shell and tube	20
Dehumidifier	10
Drums, purge or surge	20
Ducts and other sheet metal work. . . . Life of building	
Fans	15
Filters, air, oil, self-cleaning	20
Dry cleanable	10
Gages	15
Grilles and registers—	
Diffusers	20
Grilles and registers—	
Wall type	20
Ceiling	20
Window units	15
Plaques	20
Heaters—	
Boiler, oil burner and tank	20
Booster heaters	20
Electric heaters	15
Finned tube heaters, steam water cleanable tube	20
Preheaters and reheaters	20
Water heaters, open or closed type	20
Insulation—	
Cork, cold pipes and tanks	20
Magnesia, hot pipes	15
Wool felt	20
Asbestos	15
Louvers and screens, fresh air—	
Copper	25
Steel	15
Manometers	15
Motors—	
Synchronous and exciter set	20
Induction, indoor	20
Induction, weatherproof for outdoor	20
Piping, refrigerant and other	20
Pumps—	
Chilled water	20
Condenser water	20
Condensate	20
Dehumidifiers	22
Evaporative condenser	15
Sump	25
Well	25
Receivers, refrigerant	25
Regulators, suction or static pressure	5
Silica gel beds	15
Spray pond	15
Switchboard, electric panel	20
Thermometers, room type or recording	15
Tower, cooling	15
Valves—	
Relief	20
Automatic expansion and by-pass	5
Solenoid	15
Water regulating	20
Compressors, air and vacuum	20
Heaters, electric	10
Heaters, gas	15
Heating systems:	
Boilers and furnaces	20
Burner equipment—	
Gas	16
Oil	10
Radiators	25
Pumps:	
Suction, pressure and sump	13
Starters, electric	20
Switchboards, electric	25
Wells and well pumps	25

THE LAW AND YOUR PROFITS

Watch Out for "Lurking Liabilities"

CARE — AND YET more care — must be the watchword of the contractor or subcontractor if he is to avoid damage suit losses. Particularly must he be on guard respecting causes which seem remote, and yet prove perilous. A recent case (in which the names are disguised, as usual) illustrates such need.

Heating equipment was being installed by Thermon & Co. in a project under construction by Bill Durr & Son, general contractors. One day — when Thermon's work was well under way — something came up in connection with his subcontract that required Durr's careful consideration and a full discussion between them.

Subcontractor Injured By a Fall

At Durr's suggestion, Thermon went to a certain partly finished building designated by Durr as a suitable place for the conference. That's how the trouble began. How was Mr. Thermon to know of a yawning trapdoor — for it had been left open — just inside the entrance of the chosen meeting place? On the other hand, at that very moment the law was shaking a finger in Mr. Durr's direction and admonishing:

"You have invited a person to visit premises under your control. Any danger that lies inside the threshold of those premises may prove a monetary pitfall for you as well as a physical mantrap for him."

When the 55-year-old Thermon entered the building according to schedule, he plunged through the open trapdoor and sustained serious leg and knee injuries. As a result, he was unable to work for many weeks thereafter, and eventually was forced to retire. Thermon brought suit against Durr & Son for $14,555 damages covering loss of earnings until trial. The superior court awarded Thermon $12,000 and defendant Durr appealed. The appellate court of the state sustained that judgment.

He Was "Business Invitee" of General

In its decision the higher tribunal found that according to the evidence (1) Thermon was a "business invitee" despite his status as a sub-

contractor actively engaged in work on the premises; (2) these premises were under the control of general contractor Durr, who disregarded the legal principle that (3) anyone "who invites another upon premises in his possession" has a duty towards the invitee to provide reasonably safe means of ingress and egress; (4) the subcontractor was in no wise to blame and "had not been guilty of contributory negligence"; and (5) respecting such negligence the court must accept evidence most favorable to plaintiff Thermon. Furthermore, the appeals court held that the sum awarded to the heating contractor was not excessive. Judgment in his favor was affirmed.

The point of this true narrative is that any person or firm in control of premises or any part thereof, whether in the capacity of owner, contractor or subcontractor, has "a general duty . . . to exercise due care not to injure others" — and "others" may include fellow contractors or subcontractors. Indeed, as set forth in a decision in another state, such duty "is not dependent upon any payment of money but is a duty arising by operation of law rather than by contract, express or implied." Similarly, a federal court has ruled that "a contractual relationship between parties is *not* necessary to the existence of duty, the violation of which may constitute actionable negligence."

As a practical matter, we may put it this way: Suppose in the case discussed above that the situation had been reversed. Suppose the heating contractor's negligence had resulted in injury to the general contractor, to another subcontractor, or to the employees of either or both — in any case the heating contractor would have been liable for damages, even though there might have been no monetary or financial interest between the parties.

Innocent Bystanders Are Included

Innocent bystanders may even be included in this interdiction of negligence. For example, a dredge and dock contractor struck a pile with a driver after it was "obvious" the pile was broken. The blow caused "a segment to fly off to the injury of bystanders" and the court held that as a matter of law such behavior on the contractor's part might be found "negligent".

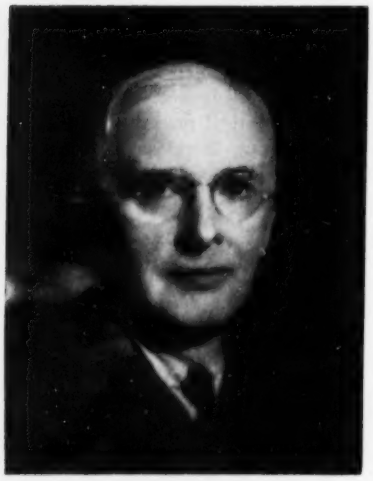
Owners, too, are entitled to full protection by contractors and subcontractors — not only against personal injury negligence, but against negligence resulting in an *injury to property itself*. Hear another state's court: A subcontractor "or one who has agreed with the owner . . . to fit up a building in a workmanlike manner is liable to the owner for negligent injury to the building in doing the work, even where there is no privity of contract between them." Definitely the court recognizes a "duty owed by subcontractors to the owner not to injure the property negligently; and such duty does not depend on or grow out of contract."

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

SAM LEWIS' PAGE

Central or Separate Heating for Industrial Buildings?



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He gives some suggestions here to a reader who asked for information on use of either a central heating plant or individual building heating installations for a large industrial group

ONE OF OUR READERS is interested in the method of heating for a very large industrial plant. While he does not send any plans, he states that there will be several detached buildings in the group. These may include an office building, a research laboratory and receiving and shipping departments, for example. Each of several different phases of manufacturing and processing will have a separate building. The particular question is whether to build a single central heating plant, or to design a separate local heating system for each major building. He requests some "arguments" for each scheme.

There are good reasons for each heating method, and possibly the most effective could be based on items that have not been disclosed in the question — such as topography and kind of fuel. I remember that the ash disposal problem dictated the use of fuel oil for one big central boiler plant for a factory that manufactures agricultural machinery.

Many colleges have progressed from an old No. 1 building that had its own boiler, until, as other separate dormitory and classroom buildings were added, the labor situation brought about abandoning the old plants and substituting a central boiler house with underground distribution mains. We are constantly extending and enlarging such central campus systems for hospitals and normal schools and universities, where separate boiler and fuel rooms, chimneys and fireman service would be prohibitive in space, noise, labor and first cost.

Recent Survey Offers Some Suggestions

A recent survey and report by my office on an institution in the midwest may give some suggestions. There are six large buildings, having different uses, all within an area about 1000 ft wide and 1500 ft long. Some of them have basements where steam and return mains may be suspended overhead to serve the different upper stories. Another large building is but one story high and has no basement. Another requires an unusual volume of hot water for testing purposes. Another building has a large cafeteria with adjacent kitchens.

The topography is favorable to a central boiler plant at a level lower than the basements of the buildings, and there is no problem of a swamp or quicksand that might make tunnels or conduits for underground heat distribution difficult. We know the heat demand for each building, so that it is possible to evaluate costs in proportion to the heat demand.

A study of the plans of each building disclosed that a boiler room and a chimney for each would usurp exceedingly valuable space that was important in the general use of the buildings.

A walk-through tunnel for central services could reach all of the buildings, somewhat after the manner that a trunk of a tree reaches the radiating limbs, so that the cost of the tunnel to each of the six buildings could be divided by six and thus become relatively low.

We decided to keep the steam mains small — so as to minimize their cost and that of the insulation — by generating steam at 100 lb pressure. This pressure, maintained in the tunnel piping, is reduced at each building — usually to a maximum of 2 lb or less.

It was convenient to locate an electric vacuum pump in each building. These pumps discharge the condensate back to the boiler house through a return main common to all and open to the atmosphere at a feedwater heater in the boiler house. By this arrangement, each building can be cut off without affecting any other building — yet the most distant heating system will operate at the same pressure as that in the nearest system.

The special assembly building (with no basement) requires heat transmitters below the windows as well as overhead unit heaters. We transfer the heat from steam to hot water, at this building, installing an electric water circulator and an expansion tank. This water system permits the flow and return mains to be overhead, with drop branches to the radiation close to the floor.

Hot water for the process building is warmed at city pressure by steam coils in two storage tanks — one delivering water at 140 deg and the other boosting the 140 deg temperature to 180 deg for the food preparation department.

Fuel in this case is bunker C preheated oil, so that one water tender per shift spends most of his time watching the control instruments and becomes available to care for emergencies. There is of course a chief engineer, who seems to be adequate for one of the shifts.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Cooling A Small Residence With A Two-Horsepower Mechanical Condensing Unit†

By H. T. Gilkey*, D. R. Bahnfleth**, and R. W. Roose***,
Urbana, Ill.

SUMMARY—The results presented in this paper were obtained in connection with the 1952 summer cooling investigation conducted in Warm-Air Heating Research Residence No. 2 at the University of Illinois. Performance data are given for a two-ton condensing unit installed in the residence and connected to the air distribution system that had been designed and used for warm-air heating. Ventilation air was mechanically introduced into the return-air side of the system at the rate of one air change per hour, and the blower was operated continuously.

The room-air temperatures increased slightly more than 1 deg above the indoor control temperature of 75 F when the outdoor design conditions were exceeded. This occurred even though the actual capacity of the unit was 4,000 Btu per hour below the design cooling load. The time lag of the heat flow through the walls was less than that predicted from information in the HEATING, VENTILATING, AIR CONDITIONING GUIDE 1952. The measured heat flow through shaded walls and the ceiling was less than the calculated heat flow. The measured heat flow through walls exposed to solar radiation was greater than the calculated heat flow. Data on operating characteristics of the unit are also included.

PREVIOUS investigations [1,2,3,4,5,6,7,8,9] in summer cooling were conducted in Warm-Air Heating Research Residence No. 1 in the summers of 1932 through 1938 and 1940. Since Research Residence No. 1 was a two and one-half story structure with a larger volume and storage effect than the smaller more typical home of post-war construction, it seemed advisable to continue the summer cooling studies in Research Residence No. 2.

The principal objectives of this investigation were:

1. Determination of the cooling load and its hourly variation when cooling Research Residence No. 2 as a whole, except the basement, under both night and day conditions.
2. Determination of the time lags in heat flow through the walls and ceiling.
3. Comparison of the actual cooling load with the cooling load calculated using the procedure outlined in THE GUIDE 1952.[10]
4. Determination of the operating characteristics of a two-ton mechanical refrigeration unit when outdoor air was introduced into the structure through the unit at the rate of one air change per hour.

Research Residence No. 2

The residence was a one-story structure of frame construction with a large amount of glass exposure and with a full basement. The south exposure of the residence is shown in Fig. 1. The exposed wall section consisted of cedar shingles, 20-lb felt building paper, shiplap sheathing on 2 in. x 4 in. studdings, 3⅝-in. mineral wool blanket insulation with vapor barrier attached, and ¼-in. plywood panels on the interior. These panels were removable to permit access to the stud spaces for changing the duct system or for in-

†This investigation was a part of the cooperative project jointly sponsored by the Engineering Experiment Station of the University of Illinois and the *National Warm Air Heating and Air Conditioning Association.*

*Research Associate in Mechanical Engineering, University of Illinois. Junior Member of ASHVE.

**Research Assistant in Mechanical Engineering, University of Illinois.

***Research Assistant Professor of Mechanical Engineering, University of Illinois. Member of ASHVE.

[1]Exponent numerals refer to References.

Presented at the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, January 1953.

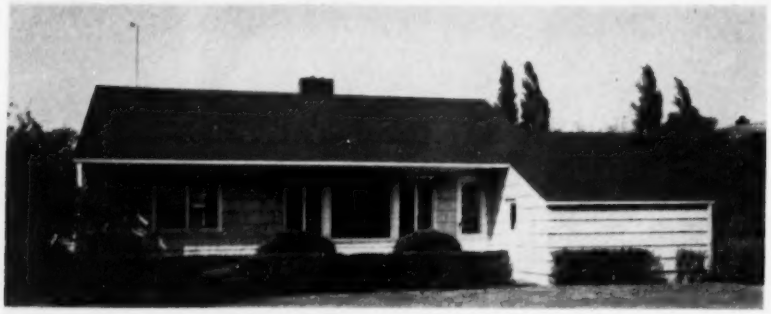


Fig. 1—South view of Research Residence No. 2

stallation of additional instrumentation. The calculated coefficient of heat transmission, U, for this wall section was 0.07 Btu per hr (sq ft) (F). All windows and doors were weatherstripped and the windows on the east and west exposures were equipped with canvas awnings. Except for one large picture window in the living room, which was fixed in place and consisted of two panes, the windows were single glazed and of the horizontal sliding type. The doors were of conventional wood and glass construction. The south exposure of the residence was shaded by a 3-ft 10-in. roof overhang. The cooling load on the structure, except for the windows, was calculated by the sol-air temperature method given in THE GUIDE 1952[10], and the recommended method using the tables given in THE GUIDE for calculating the heat gain through the windows was used. As recommended in THE GUIDE 1952, the infiltration load was based on a wind velocity of 10 mph and the actual lineal feet of crack around the doors and the windows.

The residence included several special features of construction to make possible future investigations in warm-air heating. Open-web steel joists were used in the floor and ceiling so that warm air could be circulated in either joist space to permit investigation of the performance of a heating system using floor or ceiling panels. For this summer cooling investigation, however, the ceiling joist space was filled with 5 in. of mineral wool insulation. The calculated coefficient of heat transmission, U, for this ceiling was 0.07 Btu per hr (sq ft) (F).

The conditioned space consisted of all first-story rooms. Table 1 gives a summary of the room dimensions and volumes, and a compilation of the calculated cooling load for each

Table 1—Data for Research Residence No. 2

A. Heat Transmission Coefficients, Btu per hr (sq ft) (F)	U
Insulated Frame Wall, with 3½-in. mineral wool insulation	0.07
Insulated Ceiling, with 5 in. mineral wool insulation	0.07
Outside Door — Front Hall	0.51
B. Infiltration Factors, cu ft per hr (ft of crack)	I
Door, weatherstripped	35
Window, weatherstripped	13
Fixed Window in Living Room	8

Room	Dimensions						Ceiling Area[a]	Exposure	Net Wall Area	Glass Area	Volume
	Ft	In.	×	Ft	In.						
Living Room	21	10	×	13	4		308	East	117	—	2,480
								South	89	100[b]	
South Bedroom	13	4	×	11	0		169	South	71	28	1,325
&	4	0	×	2	3			West	93	25	
South Bedroom Closets (2)	4	6	×	1	11		23	South	19	—	147
Bath	7	8	×	4	11		44	West	36	11	320
North Bedroom	11	11	×	10	4		135	West	66	25	1,050
								North	61	30	
North Bedroom Closet	5	10	×	2	4		18	North	24	—	166
								East	37	—	
Hall to Bath	6	7	×	5	2		43	—	—	—	
Front Hall	11	6	×	4	7		59	North	22	21 (door)	448
Front Hall Closet	4	0	×	2	4		9	—	—	—	91
Kitchen — Dinette	19	0	×	11	4		232	North	124	42	1,830
								East	89	12	
Total First Story							1,040	—	848	273	8,146

[a]Ceiling area includes area of partition and exterior walls.
[b]South Living Room glass area includes area of outside door having a high glass to wood area ratio.
Note: Ceiling Height of First Story — 8 ft 6 in.

Table 2—Compilation of Calculated Cooling Load for Research Residence No. 2

A. Maximum Load (Conducted and Transmitted) at 3:00 p.m. CST, Btu per hr

Room	Windows	Exterior Wall	Ceiling	Total
Living Room	3,365	201	940	4,506
South Bedroom	3,035	230	586	3,851
South Bedroom Closets (2)	[a]	[a]	[a]	[a]
Bath	880	36	256	1,172
North Bedroom	3,110	156	505	3,771
North Bedroom Closet	[a]	[a]	[a]	[a]
Hall to Bath	[a]	[a]	[a]	[a]
Front Hall	214 (door)	18	180	412
Front Hall Closet	[a]	[a]	[a]	[a]
Kitchen-Dinette	1,447	268	709	2,424
Totals	12,051	909	3,176	16,136

B. With Ventilation Air

	Sensible	Latent	Totals
Heat Gain to Rooms	16,136	—	16,136
Load of Blower	700[b]	—	700
Ventilation Load	2,590	3,320	5,910
Total for System			22,746
10 percent Miscellaneous Gains			2,275
		Grand Total	25,021

C. With Infiltration but with No Ventilation Air

	Sensible	Latent	Totals
Heat Gain to Rooms	16,136	—	16,136
Load of Blower	700[b]	—	700
Infiltration Load	913	1,167	2,080
Total for System			18,916
10 percent Miscellaneous Gains			1,892
		Grand Total	20,808

[a]Cooling load for these rooms included with larger adjoining rooms
[b]Measured load

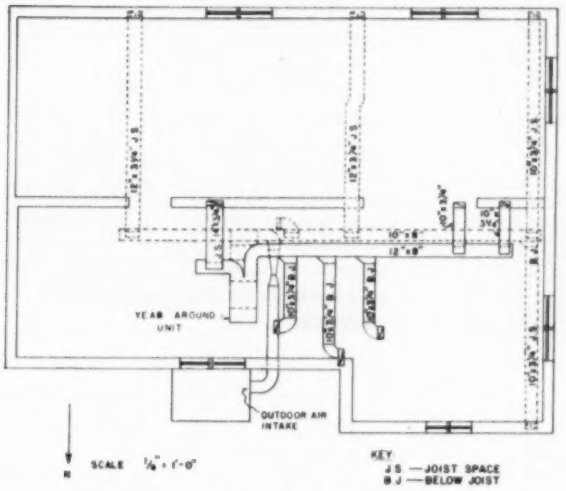


Fig. 2—Basement plan showing duct installation

Fig. 3—Floor plan of Research Residence No. 2

room is given in Table 2. The cooling load calculations were based on outdoor design conditions of 95 F dry bulb, 76 F wet bulb, and indoor conditions of 75 F dry bulb, 62.5 F wet bulb (50 percent relative humidity). The maximum calculated cooling load on a design day for the structure with one air change per hour (120 cfm) of ventilation air mechanically introduced was 25,021 Btu per hr at 3:00 p.m. CST. The maximum calculated cooling load on a design day for the structure with infiltration air only was 20,808 Btu per hr at 3:00 p.m. CST.

The residence was completely furnished but unoccupied during this investigation.

Equipment and Instrumentation

Cooling Unit

The cooling unit was one of two sections of a year around air conditioner which was installed in the basement of the residence. The conditioner occupied a floor area of 28 in. x 56 in. The furnace had a welded steel heat exchanger, and a burner sized for a rated input of 100,000 Btu per hour. The forward-curved, multiblade centrifugal fan, hereafter referred to as a blower, was equipped with a 10-in. wheel and was driven by a one-half horsepower motor and was integrally mounted in the cooling unit. The blower was rated to deliver 900 cfm, at standard air conditions, against a static pressure of 0.40 in. of water external to the unit. The return-air was drawn into the unit and through the filter and the evaporator coil to the blower. The air was then forced through the furnace and into the duct system. The elements within the cooling unit were arranged in such a manner that the filter and the evaporator coil were located at the return-air entrance into the conditioner. This coil and the blower were in an insulated compartment and were therefore isolated from the compressor and condenser, which were located in the lower part of the unit.

The refrigeration capacity of the unit was 23,800 Btu per hour with *ASRE* standard inlet air conditions of 80 F dry bulb and 67 F wet bulb at rated air delivery of 900 cfm and at 120 psi refrigerant head pressure. The semi-hermetic compressor was directly connected to the 220 volt single-phase 2 hp motor. Both the motor and the shell-and-tube type condenser were water cooled. The refrigerant used was dichlorodifluoromethane.

Duct System

The duct system used in this cooling investigation was the same one used previously in heating investigations;[11] it was of the extended-plenum type, having uniformly sized trunk ducts leading from the furnace bonnet toward the east and west ends of the basement. Fig. 2 shows the basement plan and the duct installation. The branch ducts were connected to the top or side of the trunks and were unchanged in size from the trunk take-off fitting to the register stackhead. All registers in the first-story rooms were at the high-sidewall location, 6½ ft from the floor, with the exception of the baseboard register in the front hall near the door. Fig. 3 shows the first-story plan and the register locations. All return-air intakes were located in the baseboard. The system was designed[12] in accordance with Manual 7, of the *National Warm Air Heating and Air Conditioning Association.*

Instrumentation

To measure temperatures, approximately 180 thermocouples of 24-gage copper-constantan wire were installed. Thermocouples were placed at four different levels (floor, sitting, breathing, and ceiling) on standards located near the centers of each of the first-story rooms and at three stations in the basement. The location of the temperature measur-

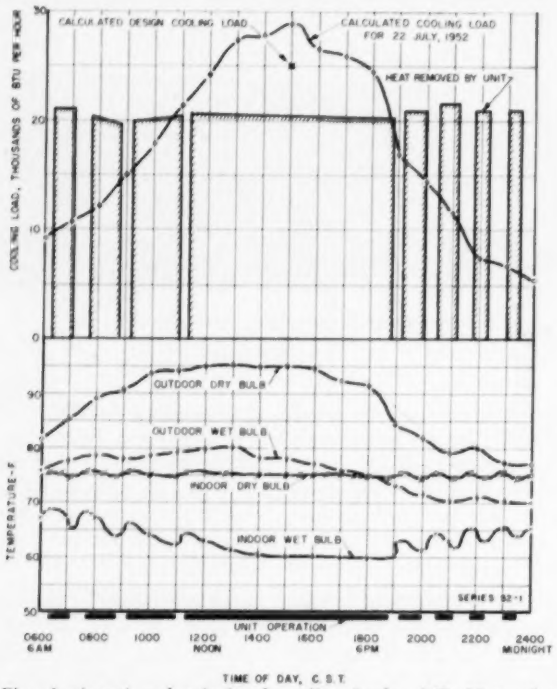


Fig. 4—Actual and calculated cooling loads of Residence for July 22, 1952

ing stations in the first-story rooms are shown in Fig. 3. Thermocouples were also installed in the ceiling and floor surfaces, on the surface and within the exterior walls, in the attic, in the duct system, and at other desired points inside and outside the Residence. Each thermocouple was connected through switches to an indicating potentiometer. It was possible to obtain a continuous record of any 28 of the 180 thermocouple stations by using recording potentiometers. Resistance thermometers were installed at the sitting level on the standards in the first-story rooms. These resistance thermometers were connected to a six-point recording resistance bridge which provided a continuous record of the temperatures at these selected points.

Heat-flow meters were installed in various locations in the house. The four meters which were installed in the outside walls were located on the exterior surface of the interior panels and next to the insulation. One such meter was located in each wall, 60 in. from the floor. Those which were placed above the ceiling were between the top ceiling surface and the attic insulation. One meter was also placed on the underside of both the north and south slopes of the roof.

Continuous records were made of the outdoor-air temperature, both dry bulb and wet bulb, the indoor relative humidity, the wind velocity, and the intensity of solar radiation received on a horizontal surface. The wind direction was noted when all observations were made.

Experimental Conditions

One main series of studies was conducted, which provided for 120 cfm of ventilation air (one air change per hr) to be introduced mechanically into the return-air side of the system. In this series the total air-flow rate through the unit was approximately 600 cfm, or 300 cfm per ton of rated capacity of the refrigeration unit. The blower was operated continuously, independent of the operation of the condensing unit. The indoor dry bulb control temperature was 75 F, but no attempt was made to control the indoor relative humidity.

The house was operated with all exterior doors and windows closed at all times. The first story was also separated from the basement by a door at the top of the basement stairs. Although all windows were equipped with venetian blinds, they were raised to the full open position and the windows were left completely uncovered except for the awnings and the roof overhang mentioned previously in the description of the residence.

Procedure

Room-air, outdoor, interior and exterior wall-surface temperatures, and temperatures within the wall were recorded at least twice daily, in the morning before the sun imposed a load on the house, and in the latter part of the afternoon when the peak load occurred. Power consumption, operation time, and water consumption by the unit were recorded at 5:30 a.m. CST each morning, the time selected to start the 24-hr test day.

Special studies of from 48 to 72 hr duration were made periodically. These studies were made during periods of clear hot weather and were made for the purpose of determining the time at which maximum cooling load was imposed on the residence, and in turn on the condensing unit, the time lag of the heat flow through the walls, and the effect of continued hot weather on the cooling load. Temperature and heat-flow meter observations were recorded hourly for approximately 18 hr each day during the special-study periods.

Results

Determination of Actual Cooling Load

The actual cooling load for the residence was determined by making a heat-balance of the various measured quantities at the condensing unit. The heat balance consisted of three components:

1. The heat equivalent of the power input to the compressor.
2. The heat removed from the conditioned air in the evaporator.
3. The total heat absorbed by the cooling water in the condensing unit.

It was assumed that the heat absorbed by the cooling water while

passing through the condensing unit could be considered as the sum of the heat absorbed by the refrigerant in the evaporator and the heat equivalent of the power input to the compressor. The two factors which validate this assumption were previously mentioned in the description of the equipment, *i.e.* the motor casing was water cooled and the condensing unit housing was insulated.

The data used to determine the actual cooling load imposed on the residence were abstracted from the results of a special study for a typical day. The day selected was July 22, 1952, because the hourly outdoor-air temperatures and the daily range of outdoor-air temperature closely approximated those of a design day. Values abstracted from hourly observations were water-flow rate, power input to the compressor and water temperature rise through the condenser. The method used in making the heat balance can best be illustrated by an example, and for this purpose the values observed at 3:00 p.m. CST, the time of maximum calculated load were employed. The heat balance was completed by applying the following equation:

$$H_c = H_e + H_{pi}$$

where

H_c = heat absorbed by the cooling water from the point of entry into the unit housing to the point at which it leaves the unit housing, Btu per hr.

H_e = heat absorbed from the air passing through the evaporator. This heat represents the net heat gain to the house including gains from walls, glass, ceiling, and ventilation air but excludes any loss through the basement walls, Btu per hr.

H_{pi} = heat equivalent of the power input to the compressor, Btu per hr.

The cooling load, H_e, is then equal to the difference $H_c - H_{pi}$.

For any experimental hour

$$H_c = 8.33\, QC_p\, (t_o - t_i)$$

where

Q = water-flow rate, pound per hour.

C_p = specific heat of water Btu per (pound) (Fahrenheit).

8.33 = density of standard water, pound per gallon, and

$(t_o - t_i)$ = temperature difference between water outlet and inlet through condensing unit, Fahrenheit.

For the time under consideration

$H_c = 8.33 \times 136\ (23.5) =$ 26,600 Btu per hour.

The heat equivalent of the power input to the unit can be found at any time as

H_{pi} = 3,413 × kilowatt-hour, where 3,413 is the heat equivalent of electrical energy, Btu per kilowatt-hour.

This value of H_{pi} for the hour under consideration is

$H_{pi} = 3{,}413 \times 1.8 = 6{,}150$ Btu per hour.

The cooling load for this hour was then found to be (26,600 − 6,150) Btu per hr or 20,450 Btu per hour. The cooling load was calculated by this method for each hour of every cycle throughout the day. Fig. 4 shows these values as a function of time. Since the capacity of the unit varied from hour to hour with changes in return-air conditions, the hourly values of capacity have been plotted at the beginning and the end of each cycle and connected with straight lines. This has been done because the actual variation in load from point to point cannot be readily determined.

The actual cooling load can also be determined as the heat removed from the air in the evaporator coil. The heat removed by the evaporator coil was computed in two parts: the sensible heat removed from the air, and the latent heat absorbed in condensing the moisture from the air. The sensible heat removed from the air at any time can be calculated as:

$$H_s = Q \times d_a \times c_p \times \Delta t$$

where

H_s = sensible heat removed from the air, Btu per hour.

Q = air-flow rate, cubic feet per hour.

d_a = density of standard air, 0.075 lb per cubic foot.

c_p = specific heat of air at constant pressure, 0.24 Btu per pound, Fahrenheit.

Table 3—Typical Operating Data and Results — 3:00 p.m. CST, July 22, 1952

1.	Outdoor Air Condition	94.8 DB, 78.1 WB, 48% RH
	Humidity Ratio, lb water per lb dry air	0.01700
	Wind	9 mph SW
2.	Indoor Air Condition (Sitting Level Temp; Avg. of all Rooms)	76.1 DB, 60.6 WB, 41% RH
	Humidity Ratio, lb water per lb dry air	0.00780
3.	Ventilation Air Condition	89.0 DB, 76.7 WB, 57% RH
	Humidity Ratio, lb water per lb dry air	0.01700
4.	Condition of Mixed Air Entering Coil	77.3 DB, 64.0 WB, 48% RH
	Humidity Ratio, lb water per lb dry air	0.00967
5.	Condition of Air Leaving Coil	54.9 DB, 52.1 WB, 83% RH
	Humidity Ratio, lb water per lb dry air	0.00760
6.	Air Temp. Drop Through Cooling Coil, F,	22.4
7.	Temp. of Cooled Air Leaving Registers (Avg. of all Registers), F	60.4
8.	Air Temp Rise in Ducts and Casing, F	5.5
9.	Basement-Air Temp at Sitting Level (Avg. of all Stations) F	77.2
10.	Flow Rate of Air Circulated, cfm	622
11.	Flow Rate of Ventilating Air, cfm	126
12.	Moisture Condensed from Air, lb per hr	4.9
13.	Heat Absorbed by Cooling Coil, Total, Btu per hr	20,380
	Heat Due to Moisture in Air, Btu per hr	5,300
	Sensible Heat, Btu per hr	15,080
14.	Water Temp Through Condensing Unit, F	Inlet 62.2, Outlet 85.7; rise 23.5
15.	Flow Rate of Condenser Water, gal per hr	136
	lb per hr	1133
16.	Heat Absorbed by Water Passing Through Condensing Unit, Btu per hr	26,600
17.	Heat Equivalent of Power Input to Compressor Motor, Btu per hr	6,150
18.	Net Cooling Load (Item 16 — Item 17), Btu per hr	20,450

Table 4—Time Lags and Times of Occurrence of Maximum Temperatures and Heat Flow in the Walls and Ceiling of Research Residence No. 2

Date	Wall Orientation	Time Maximum Value Occurred, CST: Exterior Surface Temp (1)	Room Side of Insulation Temp. (2)	Heat Meter (3)	Interior Surface Temp (4)	Exterior Surface to Interior Surface Time Lag, Hr Col. (4) - Col. (1)
7-21-52	East	11:00 a.m.	1:10 p.m.	1:15 p.m.	1:00 p.m.	2.0
	South	4:00 p.m.	6:15 p.m.	5:20 p.m.	5:50 p.m.	1.8
	West[a]	6:10 p.m.	7:40 p.m.	8:10 p.m.	7:30 p.m.	1.3
	North	8:00 p.m.	8:10 p.m.	9:10 p.m.	8:15 p.m.	0.3
	Ceiling[a]	5:00 p.m.	7:00 p.m.	7:00 p.m.	6:25 p.m.	1.4
7-22-52	East	11:20 a.m.	1:50 p.m.	1:00 p.m.	2:00 p.m.	2.7
	South	3:20 p.m.	5:30 p.m.	4:40 p.m.	4:30 p.m.	1.3
	West[a]	6:10 p.m.	7:40 p.m.	7:50 p.m.	7:25 p.m.	1.3
	North	7:45 p.m.	8:45 p.m.	10:00 p.m.	8:30 p.m.	0.8
	Ceiling[a]	4:40 p.m.	7:00 p.m.	6:30 p.m.	6:15 p.m.	1.6

[a]Values for these orientations may be noted from Figs. 5 and 6, respectively.

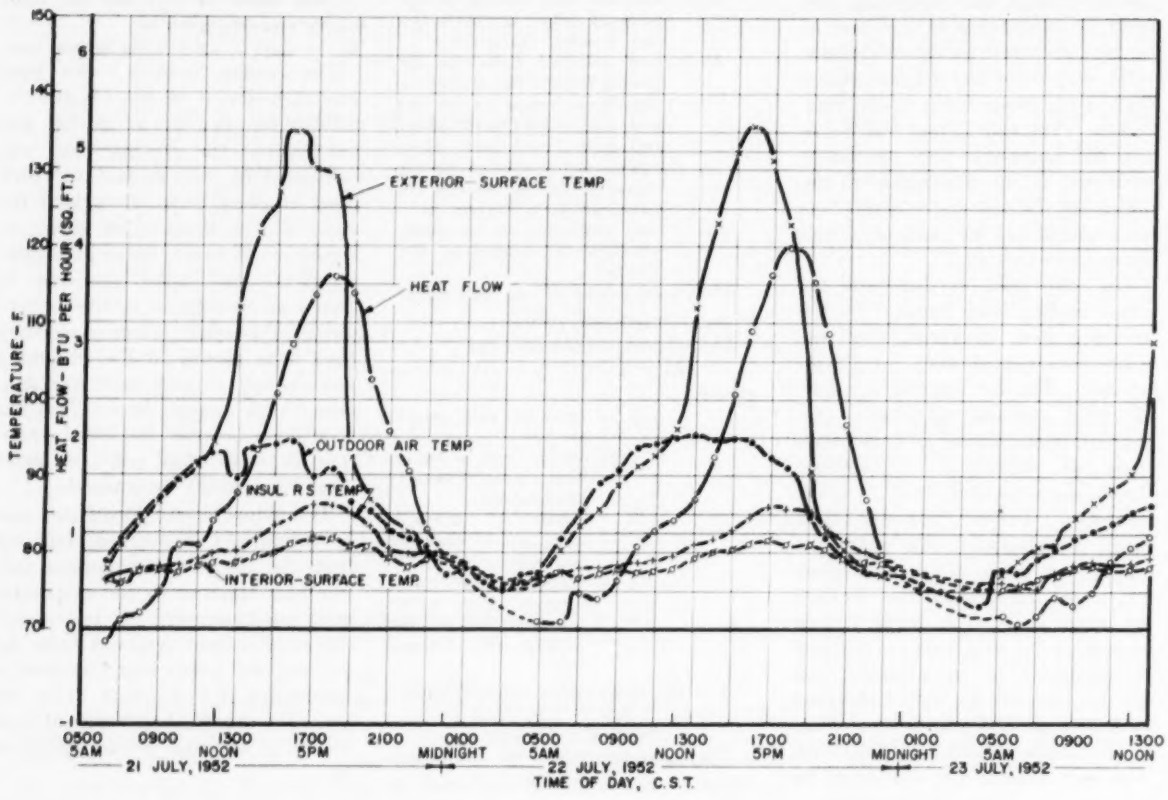


Fig. 5—Surface temperatures and heat flow through West wall

Δt = temperature drop through the evaporator coil, Fahrenheit.

The latent heat removed at any time can be calculated as:

$$H_L = 1080\ W_e$$

where

H_L = latent heat removed from the air, Btu per hour.

W_e = moisture condensing rate, pound water per hour.

1080 = the approximate amount of heat removed from the condensed moisture including superheat, latent heat, and sub-cooling, Btu per hour.

The preceding calculations have been made for the typical hour selected with the following results:

$H_s = 37{,}320 \times 0.075 \times 0.24 \times 22.4 =$ 15,080 Btu per hour.

$H_L = 1{,}080 \times 4.9 =$ 5,300 Btu per hour.

The sum of these two values gives a total of 20,380 Btu per hour as the total heat absorbed in the evaporator. This is a deviation of −0.34 percent from the net cooling load as calculated previously by using the heat balance around the condenser. During periods of continuous operation the deviation of actual cooling loads as determined by the two methods varied by less then ± 5 percent which indicates a good agreement between the two methods. For short cycles of operation, however, the heat balance at the condensing unit must be relied upon to determine the cooling load since unsteady conditions at the evaporator make an energy balance too difficult to be of any practical use. Table 3 shows the pertinent operation data and results for the typical hour selected. All of the values tabulated are measured data or have been computed by using measured values as the basis for the computation.

Time Lag

Although the cooling load imposed by the heat flow through the walls and ceiling was small in comparison to that imposed through the windows, the time lag between the outer-surface and the inner-surface maximum temperatures was important in fixing the time of the maximum cooling load. If the time lag is to be defined in this manner, however, it must be recognized that factors other than the exterior-surface temperature and the room-air temperature can affect the temperature at the inner surface of the wall or ceiling. It can be seen in Figs. 5 and 6 and in Table 4 that in several cases the interior-surface temperature attained a maximum value before either the temperature on the room-side of the insulation or the heat flow reached a maximum. A possible explanation of this may be the combined effects of solar radiation and outdoor temperature entering the rooms through the relatively large window areas. This energy which entered the struc-

ture by radiation through the windows undoubtedly caused an increase in the temperature of the interior surface by re-radiation from the floor and other wall surfaces. Large window areas such as were used in the residence are commonly found in residential construction, and thus the effects of diffuse and direct solar radiation are more severe in cooling this type of structure.

The time lags through the walls and ceiling did not remain constant from day to day. Table 4 shows that only the time lag on the west wall of the residence remained constant from July 21 to 22. Figs. 5 and 6 show that the maximum temperatures measured within the west wall and the ceiling did not change more than 0.5 F from July 21 to 22, and that the maximum heat flow changed less than 10 percent. Similar measurements on the other walls of the residence showed the same results. Furthermore, during the two days preceding this study, the maximum outdoor-air temperature was 90 F and above and the sky was mostly clear. The variations in time lag therefore cannot be attributed to a temperature build-up within the walls and ceiling. That this is true would also be indicated by the inconsistent variations in the various walls. A combination of indoor and outdoor factors such as air-temperature, humidities, wind, and sun must have been causing this effect.

Despite the lack of exact information on the time lag of the heat flow imposed by the outdoor-air temperature and solar radiation, it is apparent that it was much less than the lag which would be estimated from information in THE GUIDE, 1952. The estimated lag for the type of construction in the Residence was 5 hr; the measured lag was less than 3 hr in all cases. Although it has been shown that the interior-surface temperature and consequently the apparent time lags are affected by factors other than the exterior-surface temperatures, the heat transfer from the interior surface of the room to the room air is a function of the interior-surface temperature, the film coefficient along the surface, and the room-air temperatures. Thus, the factors which affect the surface temperatures and the time at which their maximum values occur are important only insofar as they facilitate prediction of the maximum values and the time of their occurrence. The design procedure now in use does not predict the time of occurrence of the maximum interior-surface temperatures. The magnitude

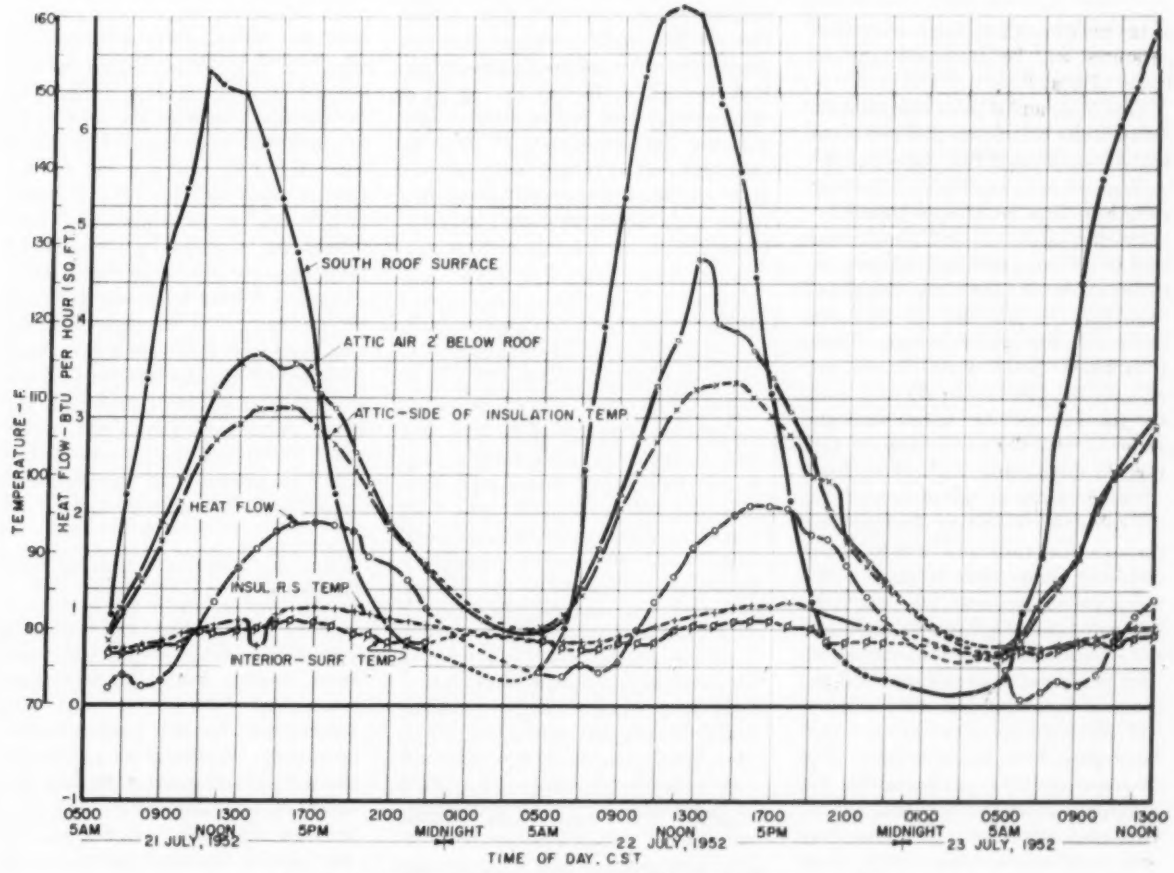


Fig. 6—Surface temperatures and heat flow through living room ceiling

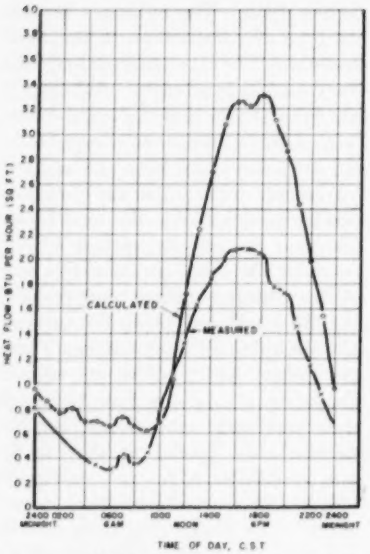


Fig. 7—Calculated and measured heat flow through living room ceiling

of the maximum interior-surface temperatures will be discussed later in terms of heat flow.

Figs. 7, 8, and 9 show comparisons between the calculated and measured heat flows through two walls and the ceiling of the residence. Because each heat-flow meter was placed between the insulation and the interior wall or ceiling panel and midway between studs or joists, the calculated heat gain is that for an insulated section of the wall or ceiling. Thus, it is based on an overall coefficient of 0.06 Btu per hr (sq ft) (F) used for the wall section rather than the value of 0.07 Btu per hr (sq ft) (F) used in the cooling load calculations.

Comparisons of the measured and the calculated values of the heat flow through the walls and ceiling of the residence show that in general the measured value was less than the calculated value when the wall was not exposed to direct solar radiation. This is shown in Fig. 7 in which the curve of measured heat flow is below the calculated curve except for a two-hour period in the morning. This discrepancy was attributed to the difference between the measured and predicted time lags. The same general conclusions were drawn from studies of the heat flow through the north and east walls of the residence. It should be noted here that the ceiling-attic-roof combination was treated as a flat roof in calculating the cooling load because the design procedure applied only to horizontal flat roofs.

The measured heat flow through the west wall was considerably greater than the calculated heat flow as shown in Fig. 8. The discrepancy was greatest during periods of greatest solar load on the wall. Although it would appear that the measured heat flow became greater than that calculated at 9:00 a.m. before the sun imposed direct radiation on the wall, the difference between the actual and predicted time lags indicated that if the calculated load were shifted three hours to the left, the curves would cross at approximately 1:00 p.m.; this would be shortly after the time at which the sun could begin to radiate directly to the west wall. That the maximum measured flow [3.95 Btu per hr (sq ft)] was 50 percent greater than the maximum calculated heat flow [2.53 Btu per hr (sq ft)] can be attributed to the direct solar radiation on the west wall of the residence and apparent discrepancies between the actual sol-air temperatures and those tabulated in THE GUIDE 1952.

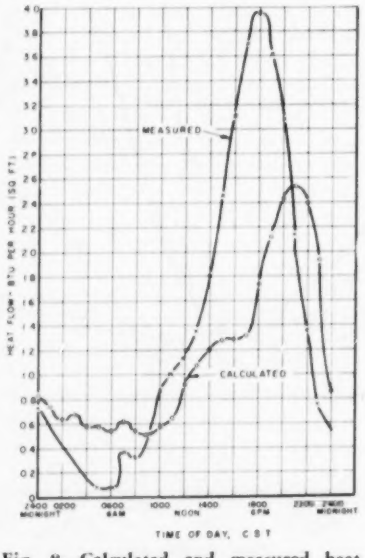


Fig. 8—Calculated and measured heat flow through West wall

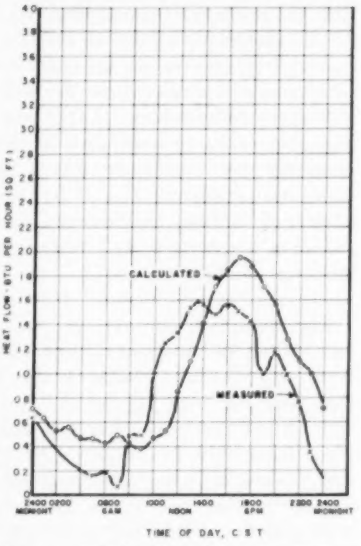


Fig. 9—Calculated and measured heat flow through South wall

The measured heat flow through the south wall of the living room was less than the calculated heat flow until after 5:00 p.m. This is shown in Fig. 9 which does not make allowance for the difference between the actual and the predicted time lags. The calculated heat flow was that for an unshaded south wall having a *U* value of 0.06 Btu per hr (sq ft) (F). Although the discrepancy between the maximum calculated and the maximum actual heat flows was less than 20 percent, it is obvious that the measured heat flow would have been considerably greater had the wall not been shaded by the overhang of the eave. As a consequence it is somewhat doubtful if the calculated load would be greater than that measured on an unshaded south wall.

Actual and Calculated Cooling Load Compared

Before attempting to draw any comparison of the actual and calculated cooling loads the significant assumptions necessary to make these calculations for the residence must be stated. As mentioned previously, the sol-air temperature method was used to calculate the heat flow through the walls and ceiling, and for July 22 the day selected, the design sol-air temperatures were ad-

justed for the outdoor-air temperatures experienced in accordance with the correction factors given in THE GUIDE 1952. The roof-attic-ceiling combination was considered as a flat roof as mentioned previously. The attic of the residence was considered to be well ventilated since louvers were installed in the east and west gables and continuous openings under the eaves 2 in. wide extended along both north and south edges of the residence. For this reason, the sol-air temperatures for the roof surface could not reasonably be applied to the attic side of the ceiling insulation. For these calculations the surface absorptivity for solar radiation was assumed to be 0.7 rather then the 0.9 value suggested in THE GUIDE 1952 for dark roof surfaces. In effect. this value of 0.7 lowered the sol-air temperatures that were applied at the attic side of the insulation approximately 22 percent.

The shaded south wall of the residence was considered to receive direct radiation from the sun when computing the wall heat gains for lack of information regarding a shaded wall. The sol-air temperatures for a north wall could be considered to apply to shaded walls; however the differences in the values of sky radiation for the two exposures and in the times of peak temperatures indicated this would introduce an error. The error introduced by considering the south wall to be unshaded would be on the conservative side but could become serious if the south wall contained a very small glass area. The heat gain through the walls which did not receive direct solar radiation such as the east wall in the north bedroom (See Fig. 3) and the east wall of the living room, was considered a function of indoor-outdoor temperature difference only taking into account the predicted 5-hr time lag.

The heat gain through the windows was computed from the tables presented in THE GUIDE 1952. A shading factor of 0.3 was applied to the solar heat gain for all windows equipped with awnings, and for all windows on the north and south exposures which were shaded by eave overhangs. No attempt was made to correct the heat gain through the windows for deviations of indoor-outdoor temperature difference from those on which the tables are based.

Table 5—Comparison of Measured and Calculated Heat Removal by Unit for July 22, 1952

Period of Day	6:00 a.m.-11:00 a.m.	11:00 a.m.-7:00 p.m.	7:00 p.m.-Midnight	Total
Measured	73,900	153,500	53,700	281,100
Calculated	71,200	204,000	51,500	326,700
Percentage Difference (Based on Measured Value)	−3.7	+32.9	−4.1	+16.2

Although the calculated design cooling load of the residence was 25,000 Btu per hour, the actual heat removed from the residence did not exceed 22,000 Btu per hour when the outdoor design conditions were reached or exceeded. Fig. 4 shows the hours of operation and amount of heat removed for July 22, 1952, a day on which the maximum outdoor dry bulb temperature was 95 F and the maximum outdoor wet bulb temperature was 80 F, 4 deg greater than the design wet bulb temperature of 76 F. The average wind velocity for the day was 6 mph from the southwest. The cooling load for this day was calculated by using the design indoor conditions (75 F dry bulb, 62.5 wet bulb) and the actual outdoor conditions to adjust the design sol-air temperatures in accordance with the correction factors given in THE GUIDE for computing the heat flow through the walls and ceiling. The heat flow through the ceiling was calculated by the method outlined in Chapter 12 of THE GUIDE 1952 (p. 257) on the Cooling Load but by using the adjusted sol-air temperatures. The heat gain through the windows was calculated by using the same values as were used in the design calculations.

The actual heat removed from the residence during the 18 hr period shown is less than the calculated heat removed would indicate. Integration of the areas under the curves of heat removed by the cooling unit shows the total to be 281,000 Btu for the eighteen-hour period. The predicted heat removal, obtained by integrating the area under the calculated cooling load curve, was 326,700 Btu, 16 percent greater than that actually removed.

A breakdown of the comparison into periods of the day is of more significance than comparing the total heat removal. Table 5 shows this comparison. For convenience, the test period has been divided into three parts: (1) the morning during the period when the cooling load was increasing; (2) the period of maximum cooling load during the hottest part of the day; and (3) the period when the cooling load was decreasing during the evening. It should also be noted that these periods coincide with the time of intermittent operation during the morning, continuous operation during the afternoon, and intermittent operation during the evening.

Between the beginning of the study at 6:00 a.m. and the end of the last of the intermittent operations at 11:00 a.m., the unit removed 73,900 Btu from the air passing through the evaporator coil, 2,700 Btu more than would be predicted from the area under the calculated curve. Although this difference is small, less than 4 percent, it is felt that during this period there should have been an increase in the internal energy of the materials and furnishings within the residence.

This heat storage effect is shown during the period of continuous unit operation from 11:00 a.m. to 7:00 p.m. The energy removed by the unit during this long operation was 153,000 Btu, more than 32 percent less than the value of 204,000 Btu predicted by calculation. Much of this difference can be attributed to energy entering the exterior surfaces of the residence and being stored within the structure, but the magnitude of heat storage is not known.

That heat storage was at least partially responsible for the difference is evidenced by two factors: (1) the constant capacity of the cooling unit, and (2) the constant air temperature at the thermostat. Even though the average room-air temperature at the sitting level rose slightly more than 1 deg during the afternoon, the energy stored in the air within the residence due to this temperature rise was insignificant.

The energy actually removed by the cooling unit during the evening (between 7:00 p.m. and midnight) was more than 4 percent greater than the calculated value of 51,500 Btu. This again shows the heat storage effect of the residence; during the period of decreasing load, the amount of energy predicted to enter the house was less than the amount actually removed. The difference between the measured and the calculated cooling loads was much smaller than would be expected, since it should be during this period that the greatest reduction in heat storage would occur.

Operating Characteristics of the Unit

As indicated in Fig. 4, the cyclical variation in room-air temperature (indoor dry bulb) was small. This small variation was characteristic of the conditions which were maintained in all of the first-story rooms during the cooling season, even though the indoor dry bulb temperature shown in Fig. 4 was measured at the room thermostat. When intermittent operation of the unit occurred, the variation in room-air temperature amounted to about 1 deg between cycles of operation. However, when the unit operated for prolonged periods of time, there was no appreciable variation in room-air temperature experienced.

The difference in room-air temperature between rooms in the Residence and at the thermostat was slightly greater than 1 deg as a maximum depending upon the time of day and the outdoor weather conditions experienced. For instance, during periods of peak load the room-air temperatures at the sitting level in the south bedroom and in the kitchen-dinette were greater than those experienced in the other rooms of the residence. The higher room-air temperature in the south bedroom was attributed to the relatively large cooling load imposed upon this room through the ceiling and through the south and west exposures as compared with the air supply to it through the one high sidewall register, and that in the kitchen to the fact that the air was delivered to the kitchen-dinette through one register located in the west wall of the dinette. The room-air temperature in the bathroom and in the north bedroom, on the other hand, was lower than that at the thermostat. This was attributed to these rooms being smaller than the south bedroom and the air supply being more adequate as compared to the load imposed upon these rooms.

The compressor operated a total of 419 hours during the period from June 7, 1952 to July 24, 1952. The total number of degree-hours above 75 F (outdoors) was 6,154 or an average of 131 per day for the period. The maximum for one day was 318 degree-hours above 75 F and the minimum was zero.

The water-flow rate through the condenser varied from 135 to 140 gal per hour of operation. Based upon the measured capacity of the condensing unit the flow rate was approximately 1.35 gal. per min. per ton. The temperature of the water entering the condenser increased from 62 F at the beginning of the cooling season to 65 F at the end of the season, and the water temperature rise through the condenser varied from 22 to 25 deg depending upon the length of operation. The total water consumption for the period June 7, 1952 to July 24, 1952 was 57,700 gallons (7720 cu ft). The compressor consumed 1.8 to 1.9 kw or 1.1 kw per measured ton, and the power consumption for the blower motor was approximately 0.2 kw. For the same period mentioned above, June 7, 1952 to July 24, 1952 the total power consumption was 836 kwhr by the compressor and 229 kwhr by the blower motor.

The compressor operated a maximum of 16.2 hr for one day during the same period. This was also the maximum operating time experienced during the cooling season. The water and power consumptions of the unit on the day of maximum operation were 2260 gallons and 30.6 kwhr, respectively. On an average day during this period, the unit operated 8.72 hours. The water and power consumption of the unit for the average day were 1216 gallons and 17.5 kwhr, respectively. During any day of the period, the blower motor consumed 4.9 kwhr.

Summary

The air conditioning system discussed in this paper consisted of a year-around air conditioner which contained a two-ton condensing unit and was connected to a duct system which was designed only for heating the residence in the winter. The registers were located in the high sidewall location on the interior walls of the rooms. The total air-flow rate through the unit was approximately 600 cfm of which 120 cfm was introduced mechanically from outdoors, and the blower was operated continuously.

The indoor dry bulb control temperature was 75 F, but no attempt was made to control the indoor relative humidity. The east and west windows of the residence were equipped with canvas awnings and the south windows were shaded by the overhanging eave. The windows were not otherwise covered. The residence was unoccupied and all windows and exterior doors were closed at all times; the first-story rooms were separated from the basement by an interior door at the top of the basement stairs.

On a day during which the hourly outdoor-air temperatures closely approximated those of a design day, the maximum measured cooling load was 20,450 Btu per hour. This value is considerably lower than the calculated design cooling load of 25,000 Btu per hour which was obtained using the sol-air temperature method given in THE GUIDE 1952. The cooling load calculated by this method for the day previously mentioned was greater than the design cooling load because the outdoor wet bulb temperature exceeded that assumed for a design day.

The time lag of the heat flow through the wall and ceiling of the residence was found to be from 2 to 3 hrs. The time lag predicted from THE GUIDE 1952 was 5 hr. It was also found that in several cases the temperatures of the interior surface of the exterior walls reached their maximum values before the temperatures within the walls reached their maximum values. Little consistency was noted, however, in the time lags through the various walls and they changed from day to day. No evidence of temperature buildups within the exterior walls was noticed.

The measured heat flow through those walls which were exposed to direct solar radiation was found to be higher than that which was calculated. In the case of the south wall and the ceiling, however, the calculated heat flow was found to be greater than the measured heat flow. The discrepancy between the measured and calculated heat flow in the south wall may be attributed to the assumption of an unshaded wall used in the calculations. In general, however, the measured heat flow was less than the calculated value for surfaces which were not exposed to direct solar radiation and greater than the calculated value for surfaces which were exposed to direct solar radiation.

The total heat removed during the 18-hour period from 6:00 a.m. to midnight on July 22, 1952, was 16 percent less than that which would be predicted from the calculated cooling load for that day. The greatest discrepancy occurred between 11:00 a.m. and 7:00 p.m., the period during which the compressor operated continuously; the calculated heat removal was almost one-third greater than that which actually occurred. In the morning and evening, however, the calculated heat removal was slightly less than the measured value.

The unit operated a total of 419 hours during the period from June 7, 1952 to July 24, 1952. During this same period, the water consumed by the unit was 57,700 gallons (7,720 cu ft). The power consumption by the compressor and the blower motor throughout this same period was 836 kwhr and 229 kwhr, respectively.

Acknowledgments

This paper reports one phase of a comprehensive investigation conducted in Warm-Air Heating Research Residence No. 2 under the terms of a cooperative agreement between the *National Warm Air Heating and Air Conditioning Association* and the *Engineering Experiment Station of the University of Illinois*. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station.

Acknowledgment is made to the manufacturers who cooperated by furnishing equipment used.

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"FATHER OF AIR CONDITIONING"

By Margaret Ingels

AIR CONDITIONING is a magic term to the public. An insight to the past fifty years in this field is covered in *Father of Air Conditioning*, the story of Dr. Willis H. Carrier, by Margaret Ingels (Country Life Press, $2.50; 170 p).

In his foreword, Cloud Wampler, president of Carrier Corp., tells of his first impressions of the inventor-engineer. *He was possessed of great knowledge and a wonderful intuitive sense.* During this interview, Dr. Carrier informed Mr. Wampler *we will not do less research and development work. We will not discharge people we have trained; and we will all work for nothing if we have to.*

Mr. Wampler ends his foreword aptly by saying Dr. Carrier would have asked the book be dedicated *to the young engineers who are today creating a better tomorrow.*

Father Of Air Conditioning reveals Dr. Carrier's boyhood, start in business, and the perfection of an idea which brought him world prominence. The book lists the volume of papers and articles written by Dr. Carrier, many of which have appeared in the Society's JOURNAL and in the TRANSACTIONS. The book also includes a *Chronological Table of Events Which Led To Modern Air Conditioning* from 1500 to 1952.

JOURNAL SECTION

Field Studies of Floor Panel Control Systems

By A. B. Algren*, E. F. Snyder, Jr.**, and J. S. Locke†, Minneapolis, Minn.

This paper is the result of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in co-operation with the University of Minnesota, Minneapolis, Minn.

SUMMARY — The significant results of a two-year study on floor panels in two factory buildings and a residence indicate, first, the importance of proper design and installation of the basic heating system; second, the field studies on the various methods of control reveal the importance of the selection and location of various control elements for successful operation of the system. The results obtained indicate the need of further studies on the application of automatic temperature controls to floor panel heating systems.

THE PURPOSE of the research program under which the studies on floor panels were made, is to determine, from actual investigation in the field, the optimum method of control for each basic type of heating panel installed in various types of structures having varying percentages of glass area. The work involved in this program came under the general direction of the Committee on Research and under the direct control of Group D of the Technical Advisory Committee on Panel Heating and Cooling‡.

Since the effectiveness of a control system is based largely on the conditions maintained within the controlled space and since desirable comfort conditions for spaces heated by panel heating systems have not as yet been outlined by Group C of the TAC on Panel Heating and Cooling, the criterion selected for this study was the *stability* of the controlled temperatures. The stability of a control point is not to be interpreted as meaning constant temperature, but rather a temperature which may vary in some relationship with load conditions including such factors as: (1) outdoor dry bulb temperature; (2) solar effects; (3) wind effects; (4) building construction (glass area, infiltration, transmission effects, and storage capacity); and (5) occupancy effects. It is felt that if stability can be realized then any comfort pattern subsequently specified by Group C can be obtained.

The magnitude of such an investigation as outlined is evident. In order to obtain basic information which would be of immediate value to the profession, it was therefore decided to limit this study to the following types of construction:

Type A—Heavy floor panel, heavy building construction, large glass area.

Type B—Heavy floor panel, light building construction, large glass area.

Type C—Heavy floor panel, light building construction, small glass area.

Type *A* Installation

The installation under study for Type A construction is a general office in a factory building located in Milwaukee. This office section is a single story, 124 ft long, 24 ft wide with a ceiling height of 10 ft. The long dimensions face north and south, the north wall consists of 75 percent glass, while the south wall is an interior partition wall. The east and west walls have no glass area. Wall construction is 8-in. cement block and 4-in. face brick with plaster for the interior finish, 2 in. of fill insulation with a 2 ft air space between the ceiling and roof. The floor or panel construction consists of 6 in. of concrete laid on a sand and gravel fill, with rubber tile as the floor covering. The windows are double glazed and weather-stripped.

The floor panel heating system consists of five grid type panels buried to a depth of 3 in. in the concrete. The piping layout is shown in Fig. 1. The pipe is welded wrought iron and varies in size and spacing as follows:

Northeast panel section, 1-in. pipe on 18-in. centers.

Northwest panel section, 1-in. pipe on 18-in. centers.

Center panel section (North), 1¼-in. pipe on 12-in. centers.

Center panel section (South), ¾-in. pipe on 24-in. centers.

East panel section, 1¼-in. pipe on 18-in. centers.

All headers are 2-in. pipes.

The source of hot water for the floor panel is a water-to-water converter to which the hot water from a steam boiler is circulated by means of a converter pump. The intermittent operation of the pump controls the temperature in the converter. A constant source of hot water is available to the converter by means of a low limit temperature controller located below the water level in the boiler, and controlling the burner

*Professor, Department of Mechanical Engineering, University of Minnesota. Member of ASHVE.

**Supervisor, Products Application, Commercial Division, Minneapolis-Honeywell Regulator Co. Member of ASHVE.

†Sales Manager, Commercial Division, Minneapolis-Honeywell Regulator Co. Member of ASHVE.

‡Personnel — Group D: E. F. Snyder, Jr., *chairman;* A. B. Algren, *vice chairman;* H. W. Alyea, Louis Barfus, S. D. Browne, R. L. Campbell, C. A. Gustafson, W. J. Hajek, H. H. Kieckhefer, W. H. Kliever, H. T. Kucera, J. S. Locke, J. F. McCauley, P. F. Neess, L. C. Plaehn, J. K. M. Pryke, A. O. Roche, Jr., C. W. Signor.

Presented at the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, January 1953.

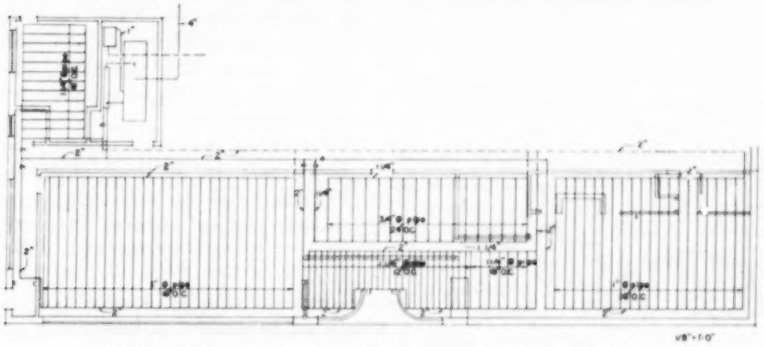


Fig. 1—Heating system piping diagram for Installation A

so as to maintain a minimum boiler water temperature.

The control systems furnished for the 1951-1952 heating season provided the following methods of control:

System Number 1: Room thermostat controlling the panel pump. Water temperature variable from outside temperature by controlling converter pump.

System Number 2: Room thermostat controlling panel pump. Converter water temperature constant.

System Number 3: Proportioning valve controlled from outside temperature. Panel water temperature variable. Converter water temperature constant.

System Number 4: Proportioning valve from outside temperature with room thermostat as a high limit control. Panel water temperature variable. Converter water temperature constant.

System Number 5: Room thermostat controls proportioning valve. Panel water temperature variable. Converter water temperature constant.

In addition, the room thermostat controlling the panel pump can be prevented from acting as an operating control at any time by setting it to its highest temperature setting. Schematic wiring diagrams for each of these control systems are shown in Figs. 2 and 3.

Type *B* Installation

The installation under study for Type B construction is a floor panel heating system for the factory area of a second Milwaukee plant.

This is a single story building, 247 ft long, 92 ft wide with a ceiling height of 18 ft. The long dimension faces north and south. The north and south walls each have approximately 46 percent glass area, the east wall 50 percent glass area, while the west wall is an interior partition wall. Wall construction is 8 in. of common brick and 4 in. of face brick. Ceiling construction consists of 1-½ in. of wood with 1 in. rigid insulation. Floor construction is 6 in. of reinforced concrete laid on 3 ft of gravel fill with no floor surface covering. Windows are single glazed industrial type glass with no weather stripping.

The floor panel heating system for each zone consists of ½-in. copper tubing, spaced on 12-in. centers, buried 4 in. in the concrete and laid in a continuous coil. Heat is supplied by an oil-fired hot water boiler.

This installation has six zones of floor panel, four being in the manufacturing space and two in the office section. In addition to the two floor panel zones, the office section includes some wall panels.

The control systems furnished for the 1951-1952 heating season provided the following methods of control:

System Number 1: Boiler water temperature varying with outdoor temperature, with proportioning control on three-way mixing valve for each zone.

System Number 2: Constant boiler water temperature, with proportioning control on three-way mixing valve for each zone.

System Number 3: Boiler water temperature varying with outdoor temperature, three-way mixing valves operating as on-off valves. Fig. 4 shows both the panel piping layout and the control piping diagram for the manufacturing section only.

Type *C* Installation

The installation under study for Type C construction is a residence located at Minneapolis. This residence is of wood frame construction, single story with a floor area of approximately 1450 sq ft. The floor

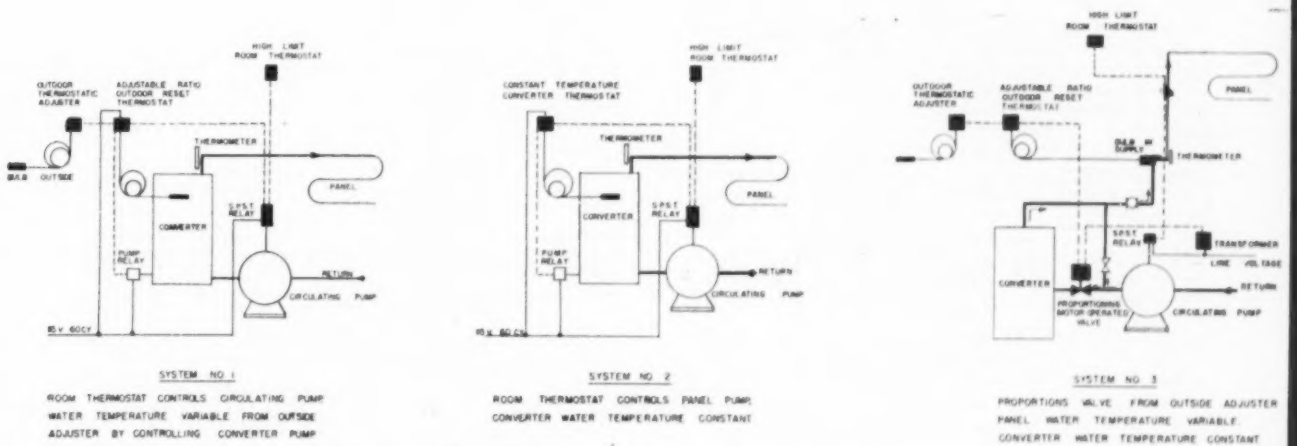


Fig. 2—Schematic diagram of control systems for Installation A

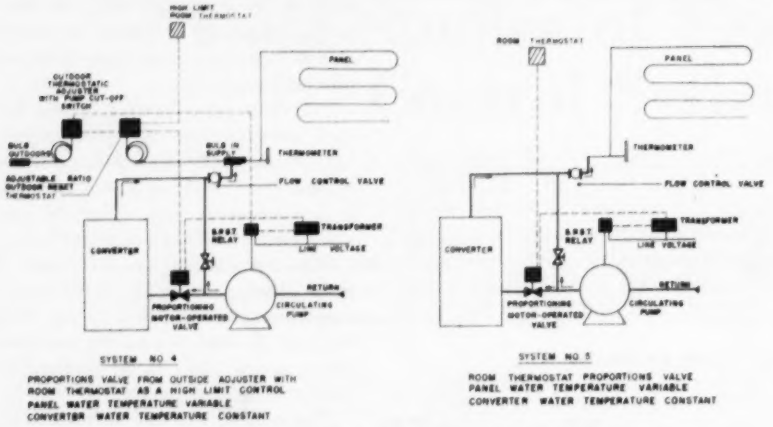


Fig. 3—Schematic diagram of control systems for Installation A

slab is divided into two sections of approximately equal areas. One section is over an unexcavated area and is constructed of 5-½ in. of reinforced concrete laid on a 4-in. gravel fill. Perimeter insulation was used and consisted of 1-in. thick edge insulation installed vertically to a depth of 8 in. below top of slab with 2-in. thick load bearing insulation around the outside wall laid on the gravel fill and extending a distance of 3 ft inward from the outside wall.

The other section is over an excavated area and is constructed of 10-in. bar joists, on 20-in. centers, 1-½ in. of low density concrete on expanded wire mesh and 3-½ in. of concrete.

The floor panel heating system consists of ¾-in. copper tubing spaced 12-in. on centers buried 3-½ in. in the concrete. The panel is divided into five circuits and each circuit consists of a continuous coil. Heat is supplied by a gas-fired hot water boiler.

The area over the unexcavated portion includes the living room and bedroom, while the area over the excavated portion includes the bathroom, den, hall, kitchen and utility room.

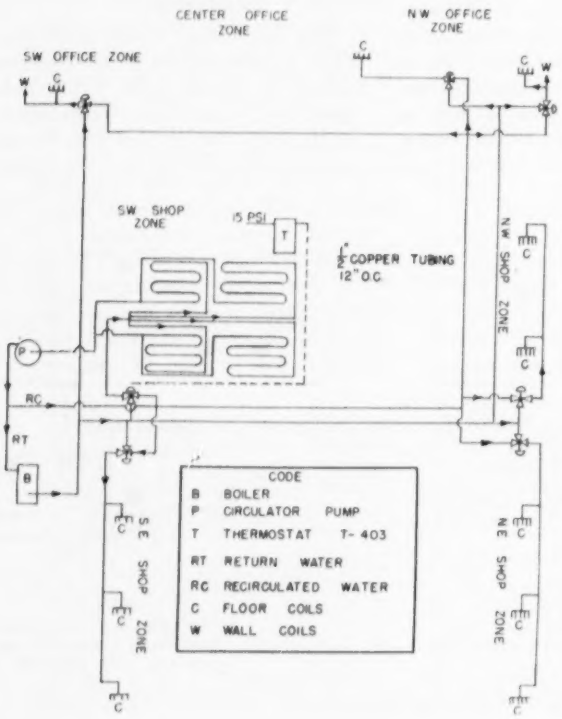
The residence is divided into four zones which are described as follows:

Zone I: The bathroom has a north exposure with a glass area of approximately 20 percent of the wall area. The floor covering is tile laid directly on the concrete slab.

The den has two exposed walls; the north wall is fully exposed and the west wall is adjacent to an unheated garage. Glass area for the north wall is approximately 25 percent. The floor covering consists of a 40 oz combination rubber and fiber padding and heavy carpeting.

Zone II: The master bedroom has both north and east exposures. Glass area for the north wall is 10 percent of the wall area, and for the east wall is 25 percent. The floor covering is 13/16-in. thick oak parquet flooring laid directly on the concrete.

Zone III: The living room, dinette and hallway have both south and east exposures. Glass area for the east wall is approximately 40 percent of the wall area,



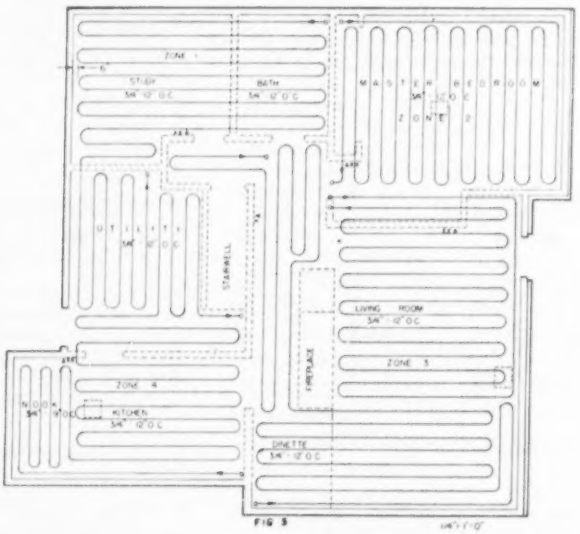


Fig. 5—Minneapolis residence piping diagram for Installation C

Fig. 4—Schematic radiant heating diagram for Installation B

and for the south wall approximately 30 percent. The floor covering consists of 40 oz combination rubber and fiber padding and heavy carpeting.

Zone IV: *Zone IV* consists of the kitchen, breakfast nook and utility room. The kitchen and breakfast nook have both south and west exposures. Glass area for the south wall is 10 percent of the wall area and for the west wall 25 percent. The utility room has partially west exposure with glass area 25 percent of the wall area. The panel piping layout for the residence is shown in Fig. 5. The control systems furnished for the 1951-1952 heating season provided the control methods outlined in Table 1. The wiring diagram for these control systems is shown in Fig. 6.

The piping system for this installation was so designed as to permit the use of controls from any source. This installation also lends itself to the study of the effect of carpeting, wood floor, tile and linoleum floor on panel heat transmission rates.

Instrumentation

The instrumentation of these projects consisted of the location of 12 thermocouples for installations *A* and *B* with 24 thermocouples for installation *C*. These thermocouples consisted of 24-gage, copper-constantan thermocouple wires, soldered at the hot junction and taped to the surface of the copper pipes. It was felt that due to the high conductivity of copper, the surface reading of the copper pipes would give essentially the same reading as a thermocouple immersed in the heating medium. In order to eliminate the possibility of lead conduction, the thermocouple leads from the hot junction were attached to the surface under measurement for a distance of 36 to 40 in. All thermocouple leads were returned to a central location and connected to 12 point, electronic strip-chart recorders. Those thermocouple leads which were embedded in the ground or concrete slab were encased in a vapor-protective membrane.

The strip-chart recorders were of the automatic type and were serviced and calibrated periodically during the period of the tests. In addition, each point on the recorder printed every 30 sec, giving a complete record every 6 min. The calibrated accuracy of the recorder is + 1/5 of 1 percent of the scale span; however, physical limitations of the chart size permit a reading accuracy of ½ deg.

The instrumentation of both installations *A* and *B* included the following thermocouple locations for continuous temperature recordings:

1. Outside dry bulb temperature
2. Recorder case temperature

Space Temperatures (Located Vertically in Line)

3. Dry bulb temperature at thermostat
4. Dry bulb temperature at 60-in. level
5. Dry bulb temperature at 30-in. level

Panel Surface Temperatures

6. Over outlet pipes
7. Between outlet pipes
8. Over inlet pipes
9. Between inlet pipes

Water Temperatures (At Pipe Surfaces)

10. Outlet from panel
11. Inlet to panel
12. At boiler

The instrumentation for installation C included the following thermocouple locations for continuous temperature recordings for each zone:

Water Temperatures (At Pipe Surfaces)

1. Panel supply water temperature for each zone
2. Return water temperature for each zone
3. Boiler water supply
4. Boiler water return

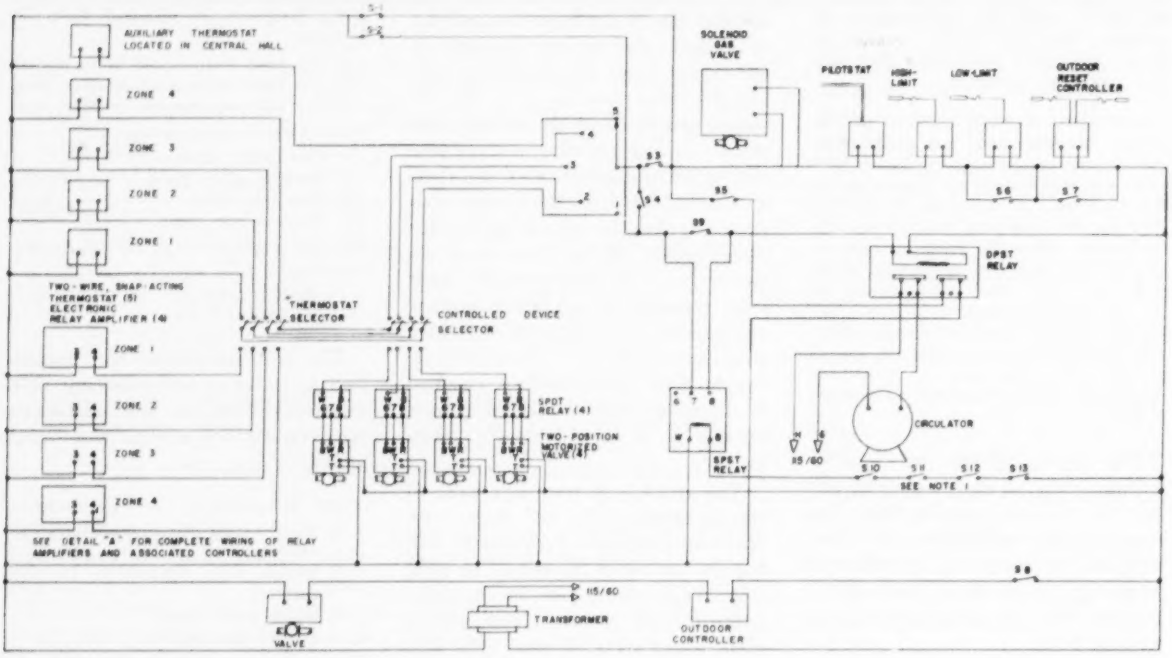
Other Temperatures and Readings Recorded

5. Room dry bulb temperature at thermostat in each zone
6. Outside dry bulb
7. Heat meter readings
8. Temperatures at the top and bottom of slab, and under insulation at each of the heat meter locations.

For the purpose of future study, low-resistance, low-inertia, heat flow meters of the type developed at the

Table 1—Control Methods for Installation *C*

Mode of Operation			Control Mode Selectors Position	Zone Selector Position	Therm Selector Position	Controlled Device Selector Position
Controlled Device	Thermostat Type	Water Temp				
Motorized Valve on each of 4 zones with continuous circulator operation	Electronic	Fixed	1	—	Electronic	Motorized Valve
	Electronic	Reset	2	—	Electronic	Motorized Valve
	Electric	Fixed	1	—	Electric	Motorized Valve
	Electric	Reset	2	—	Electric	Motorized Valve
Circulator controlled from any one of 4 zones or hall electric thermostat	Electronic	Fixed	3	Desired Zone	Electronic	Burner-Circulator
	Electronic	Reset	4	Desired Zone	Electronic	Burner-Circulator
	Electric	Fixed	3	Desired Zone	Electric	Burner-Circulator
	Electric	Reset	4	Desired Zone	Electric	Burner-Circulator
Burner controlled from any one of 4 zones or hall electric thermostat. Continuous circulator operation	Electronic	—	5	Desired Zone	Electronic	Burner-Circulator
	Electric	—	5	Desired Zone	Electric	Burner-Circulator
Burner and circulator controlled simultaneously from any one of 4 zones or hall electric thermostat	Electronic	—	6	Desired Zone	Electronic	Burner-Circulator
	Electric	—	6	Desired Zone	Electric	Burner-Circulator
Circulator controlled by any one of five electric thermostats	Electric	Fixed	7	Desired Zone	Electric	Burner-Circulator



ASHVE Research Laboratory[1] and thermocouples were installed during construction. The locations of the heat flow meters are as follows:

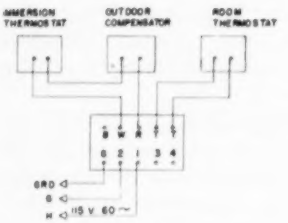
1. In center section of *Zone II*, at the top of concrete slab and at the bottom of the concrete slab.
2. Along outside wall of *Zone III*, at top of concrete slab, at bottom of concrete slab, and under the 2-in. thick perimeter insulation.
3. In center section of *Zone IV*, at top of concrete slab, and on basement ceiling.

Testing Procedure

During the 1951-1952 heating season, an average time period of approximately two weeks was chosen for the operation of each control system in the three installations.

The strip-charts were periodically removed from the recorders and reviewed at the University of Minnesota. The equipment employed in reviewing the charts consisted of a special table which facilitated the inspection of the charts by mechanically unrolling them across an illuminated ground glass surface.

From the chart covering the period of operation of a specific control system, several periods were chosen to represent various temperature ranges of outside temperature. In general, for these temperature ranges the most severe temperature fluctuations were selected, since it was felt that these fluctuations imposed the most difficult conditions upon the control system.



NOTES

1. SWITCHES S10 – S13 ARE INSTALLED ON THE MOTOR SHAFTS OF THE MOTORIZED VALVE AND EACH SWITCH IS CLOSED WHEN THE ASSOCIATED VALVE IS CLOSED
2. SWITCHES S1–S9 ARE OPERATED BY THE CONTROL-MODE SELECTOR SWITCHES IN ACCORDANCE WITH THE SWITCH SCHEDULE

MODE OF CONTROL	WATER TEMP	SWITCH ACTION S1	S2	S3	S4	S5	S6	S7	S8	S9
VALVE CONTROL-CONTINUOUS CIRCULATOR	FIXED	CL	CL	OP	OP	OP	OP	CL	OP	OP
VALVE CONTROL-CONTINUOUS CIRCULATOR	RESET	CL	CL	OP	OP	OP	CL	OP	OP	OP
CIRCULATOR CONTROL	FIXED	CL	OP	OP	CL	OP	OP	CL	OP	CL
CIRCULATOR CONTROL	RESET	CL	OP	OP	CL	OP	CL	OP	OP	CL
BURNER CONTROL-CONTINUOUS CIRCULATOR		OP	CL	CL	OP	OP	CL	CL	OP	CL
BURNER & CIRCULATOR CONTROL		OP	OP	OP	CL	CL	CL	CL	OP	CL
CONTINUOUS CIRCULATOR CONTROL	FIXED	CL	OP	OP	CL	OP	OP	CL	CL	CL

SWITCH SCHEDULE

IDENTIFICATION OF ZONES
ZONE NO 1 - DEN
ZONE NO 2 - BEDROOM
ZONE NO 3 - LIVING-ROOM
ZONE NO 4 KITCHEN & UTILITY

SCHEMATIC CIRCUIT
HEATING CONTROL INSTALLATION

Fig. 6—Minneapolis residence wiring diagram for Installation C

Results

Due to the large number of temperatures recorded on the strip-chart, it was difficult to present this information in chart form which would be of practical value; therefore, in reviewing the charts an attempt was made to pick out those points which represented the trends of tempera-

[1] A Low-Inertia, Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum, and G. V. Parmelee (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May, 1952).

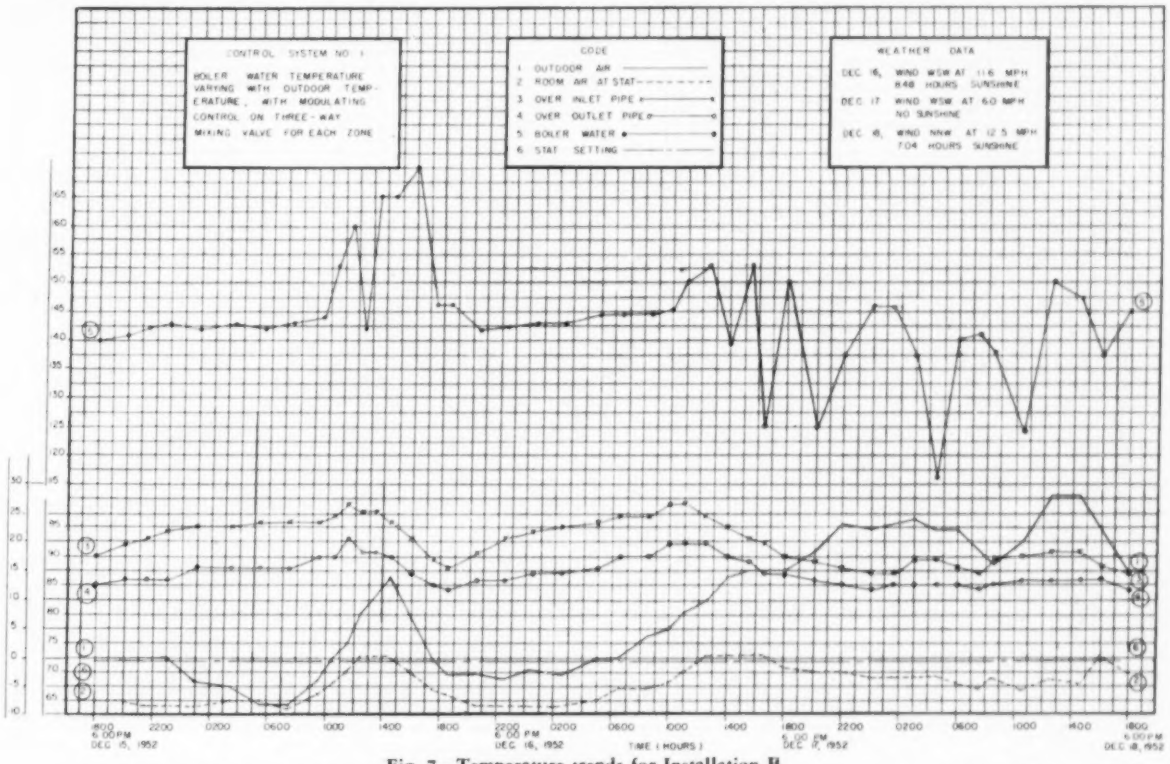

CONTROL SYSTEM NO. 1
BOILER WATER TEMPERATURE VARYING WITH OUTDOOR TEMPERATURE, WITH MODULATING CONTROL ON THREE-WAY MIXING VALVE FOR EACH ZONE
CODE
1 OUTDOOR AIR
2 ROOM AIR AT STAT
3 OVER INLET PIPE
4 OVER OUTLET PIPE
5 BOILER WATER
6 STAT SETTING
WEATHER DATA
DEC. 16, WIND WSW AT 11.6 MPH 8.48 HOURS SUNSHINE
DEC. 17 WIND WSW AT 6.0 MPH NO SUNSHINE
DEC. 18, WIND NNW AT 12.5 MPH 7.04 HOURS SUNSHINE
TIME (HOURS)

Fig. 7—Temperature trends for Installation B

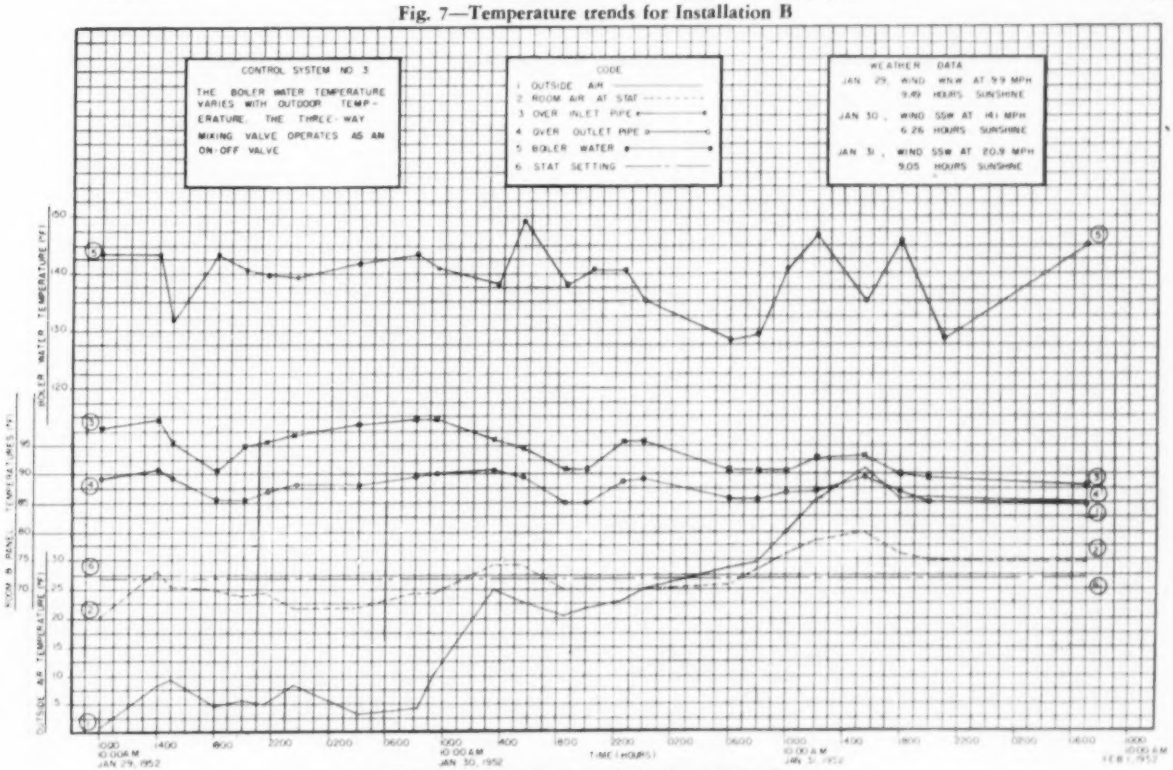

CONTROL SYSTEM NO. 3
THE BOILER WATER TEMPERATURE VARIES WITH OUTDOOR TEMPERATURE. THE THREE-WAY MIXING VALVE OPERATES AS AN ON-OFF VALVE
CODE
1 OUTSIDE AIR
2 ROOM AIR AT STAT
3 OVER INLET PIPE
4 OVER OUTLET PIPE
5 BOILER WATER
6 STAT SETTING
WEATHER DATA
JAN. 29, WIND WNW AT 9.9 MPH 9.49 HOURS SUNSHINE
JAN. 30, WIND SSW AT 14.1 MPH 6.26 HOURS SUNSHINE
JAN. 31, WIND SSW AT 20.9 MPH 9.05 HOURS SUNSHINE
BOILER WATER TEMPERATURE (°F)
ROOM & OUTSIDE AIR TEMPERATURES (°F)
TIME (HOURS)

Fig. 8—Temperature trends for Installation B

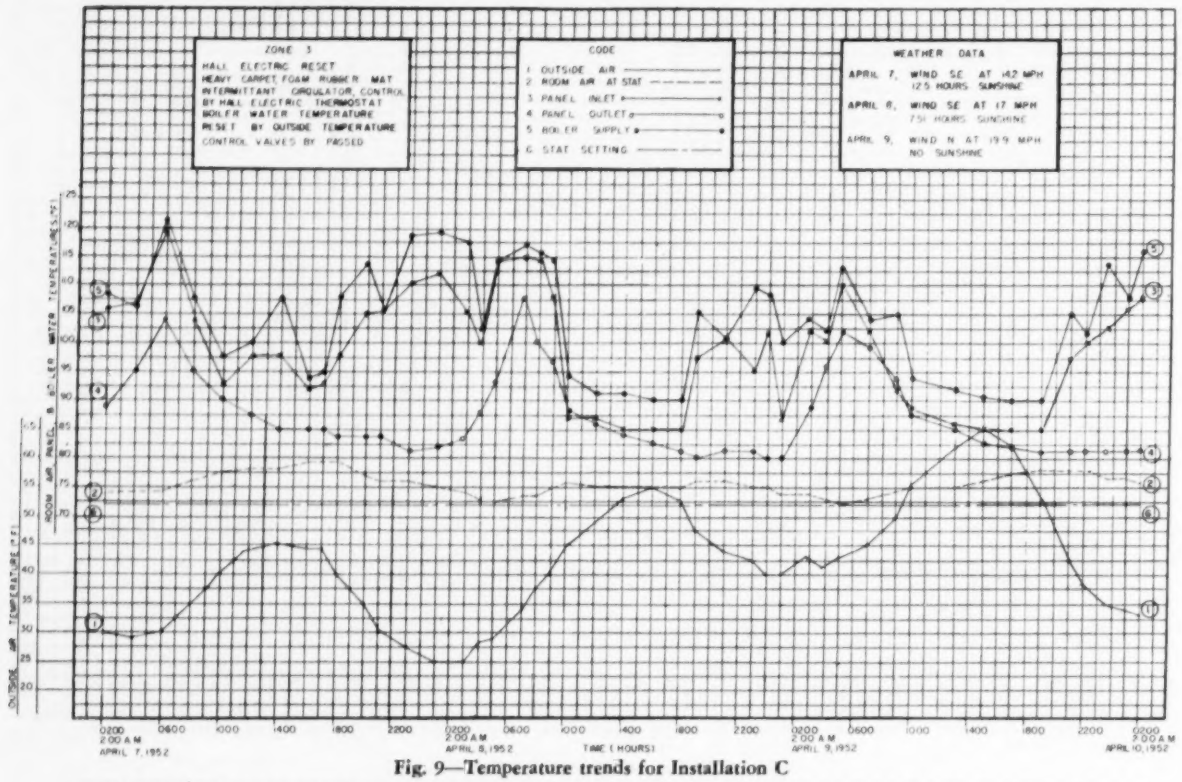


Fig. 9—Temperature trends for Installation C

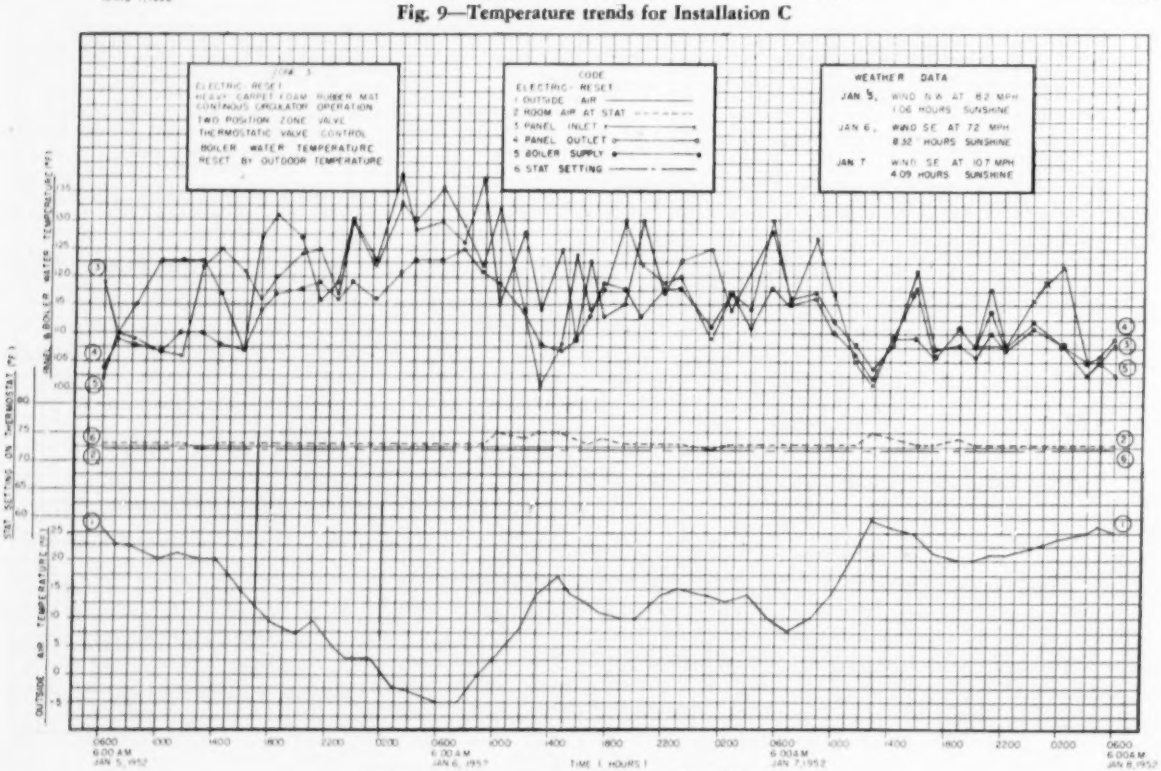


Fig. 10—Temperature trends for Installation C

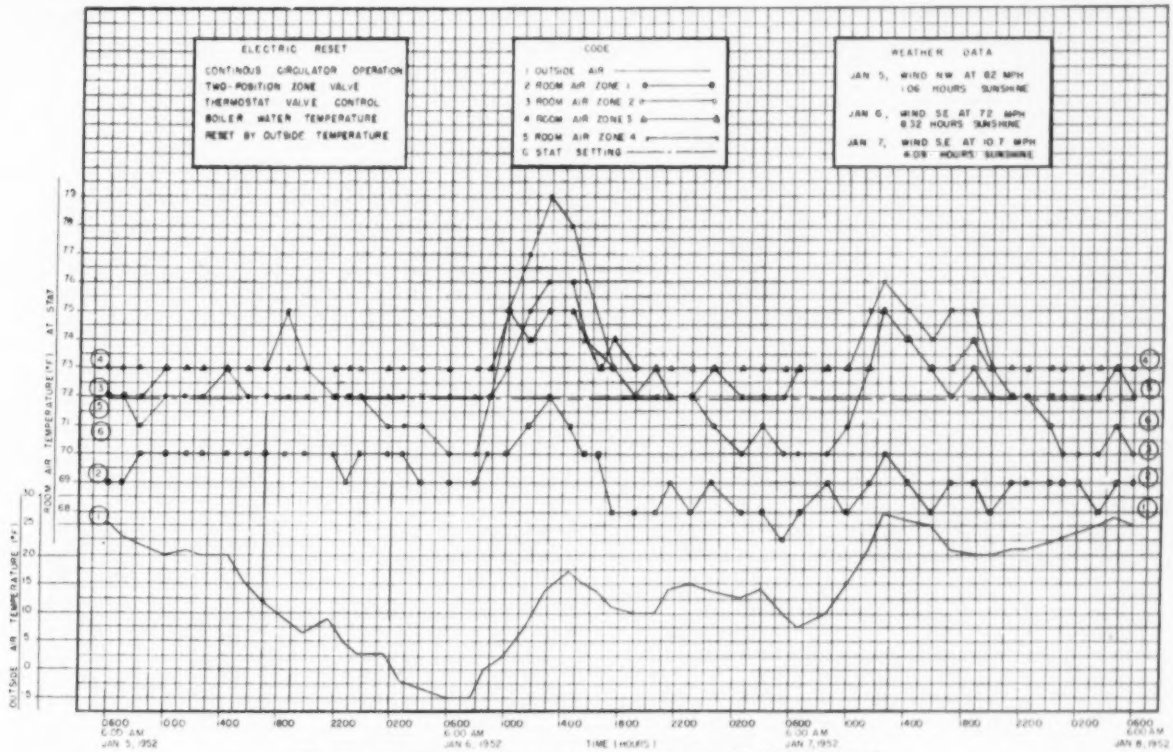


Fig. 11—Comparison of zone room temperatures for Installation C

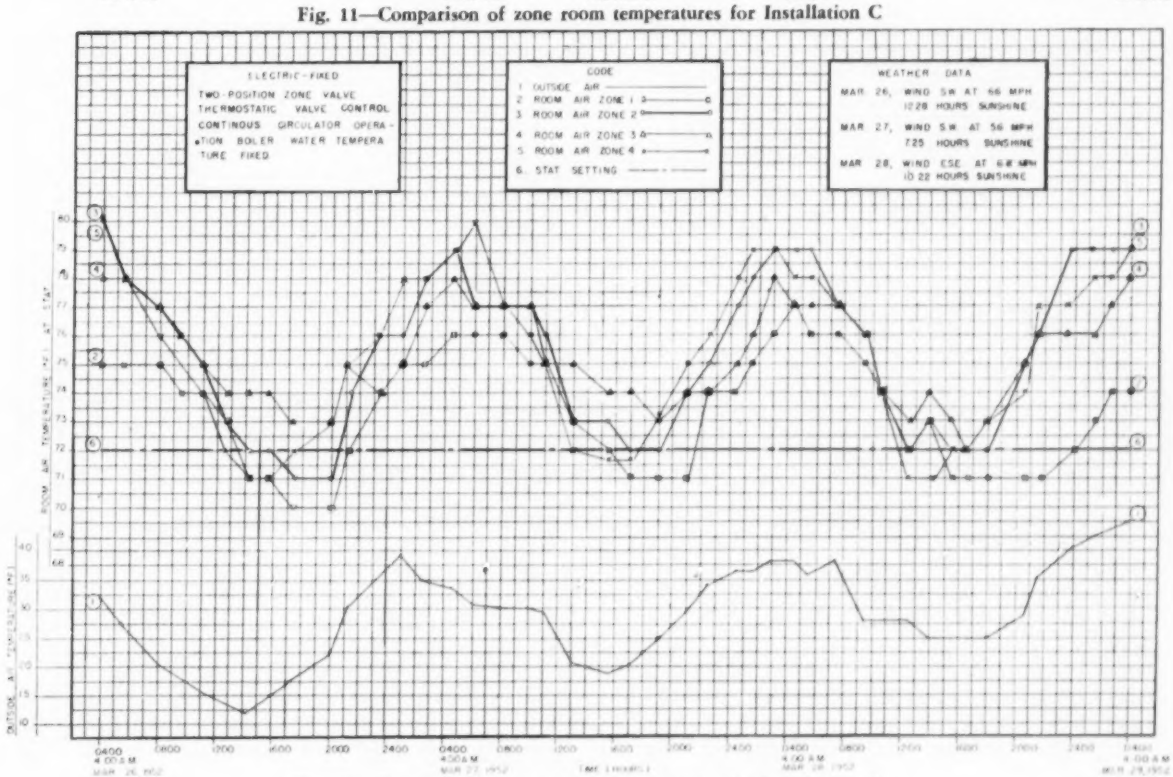

ELECTRIC-FIXED
TWO-POSITION ZONE VALVE
THERMOSTATIC VALVE CONTROL
CONTINOUS CIRCULATOR OPERATION BOILER WATER TEMPERATURE FIXED
CODE
1 OUTSIDE AIR
2 ROOM AIR ZONE 1
3 ROOM AIR ZONE 2
4 ROOM AIR ZONE 3
5 ROOM AIR ZONE 4
6 STAT SETTING
WEATHER DATA
MAR 26, WIND SW AT 66 MPH
12.28 HOURS SUNSHINE
MAR 27, WIND SW AT 56 MPH
7.25 HOURS SUNSHINE
MAR 28, WIND ESE AT 6.8 MPH
10.22 HOURS SUNSHINE
ROOM AIR TEMPERATURE (°F) AT STAT
OUTSIDE AIR TEMPERATURE (°F)
TIME (HOURS)

Fig. 12—Comparison of zone room temperatures for Installation C

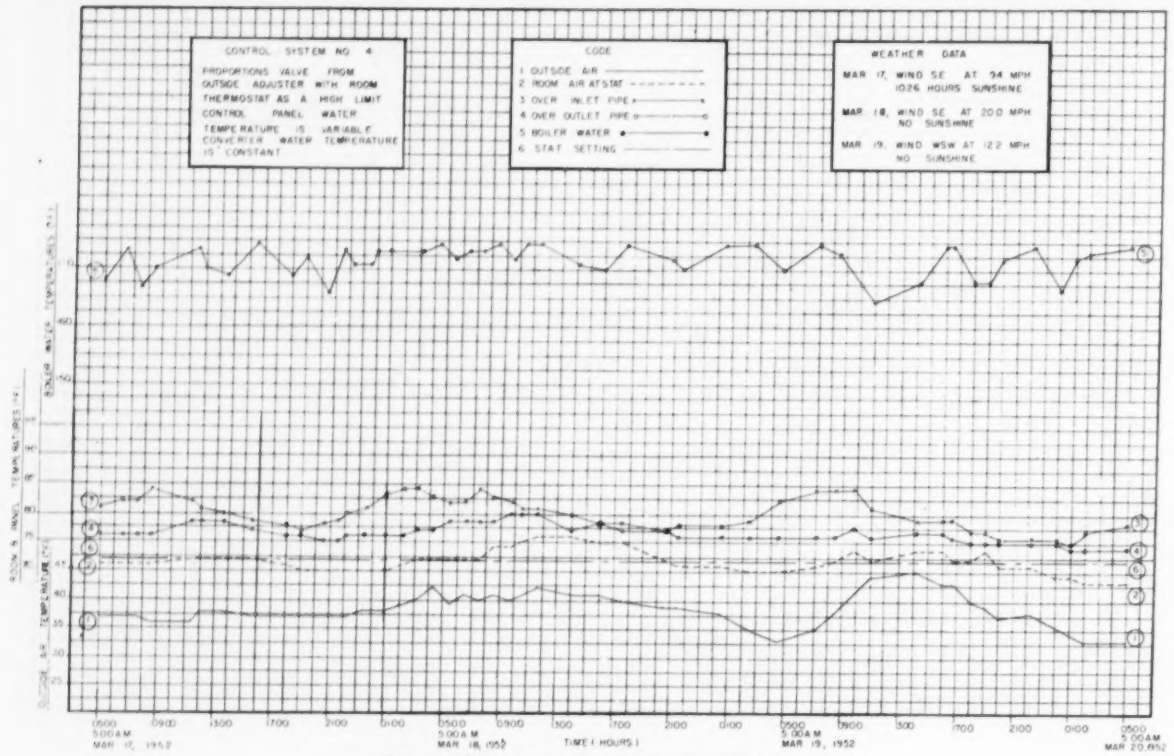

CONTROL SYSTEM NO. 4
PROPORTIONS VALVE FROM OUTSIDE ADJUSTER WITH ROOM THERMOSTAT AS A HIGH LIMIT CONTROL PANEL WATER TEMPERATURE IS VARIABLE CONVERTER WATER TEMPERATURE IS CONSTANT
CODE
1 OUTSIDE AIR
2 ROOM AIR AT STAT
3 OVER INLET PIPE
4 OVER OUTLET PIPE
5 BOILER WATER
6 STAT SETTING
WEATHER DATA
MAR 17, WIND SE AT 24 MPH 10.26 HOURS SUNSHINE
MAR 18, WIND SE AT 20.0 MPH NO SUNSHINE
MAR 19, WIND WSW AT 12.2 MPH NO SUNSHINE
TIME (HOURS)
5:00 A.M. MAR 18, 1952
5:00 A.M. MAR 19, 1952

Fig. 13—Temperature trends for Installation A

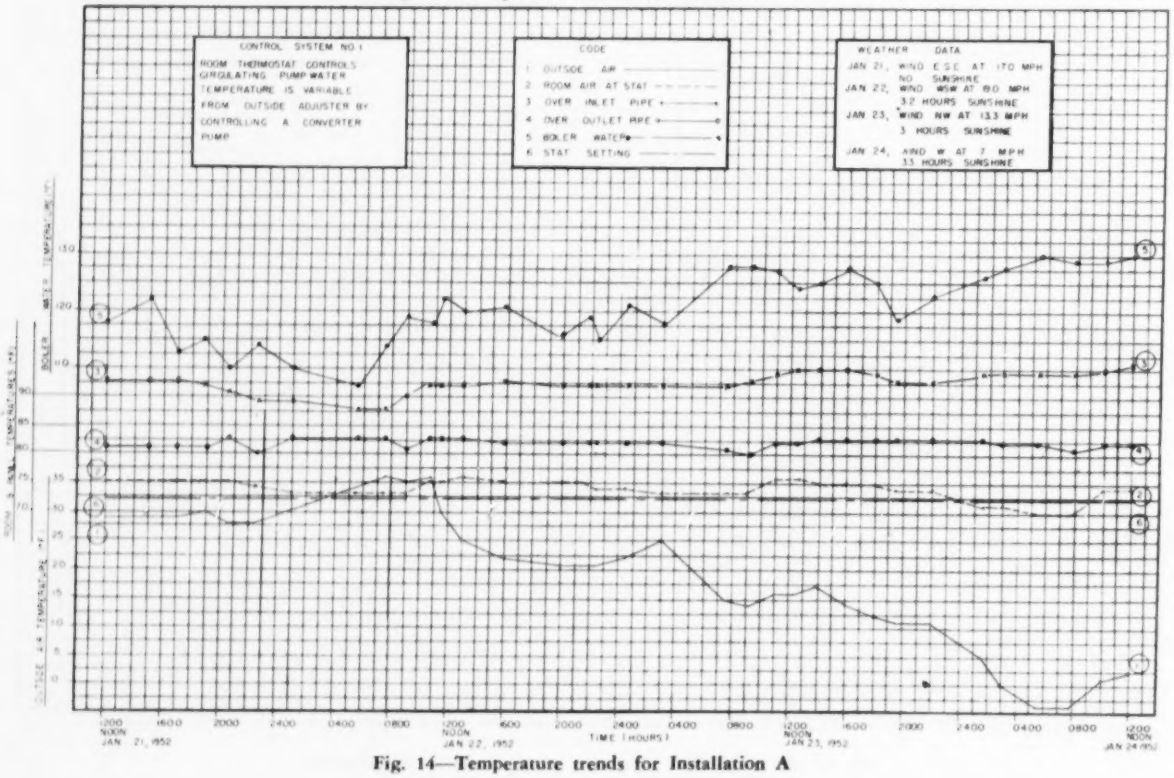

CONTROL SYSTEM NO. 1
ROOM THERMOSTAT CONTROLS CIRCULATING PUMP WATER TEMPERATURE IS VARIABLE FROM OUTSIDE ADJUSTER BY CONTROLLING A CONVERTER PUMP
CODE
1 OUTSIDE AIR
2 ROOM AIR AT STAT
3 OVER INLET PIPE
4 OVER OUTLET PIPE
5 BOILER WATER
6 STAT SETTING
WEATHER DATA
JAN 21, WIND E S E AT 17.0 MPH NO SUNSHINE
JAN 22, WIND WSW AT 19.0 MPH 3.2 HOURS SUNSHINE
JAN 23, WIND NW AT 13.3 MPH 3 HOURS SUNSHINE
JAN 24, WIND W AT 7 MPH 3.3 HOURS SUNSHINE
TIME (HOURS)
JAN 22, 1952
JAN 23, 1952

Fig. 14—Temperature trends for Installation A

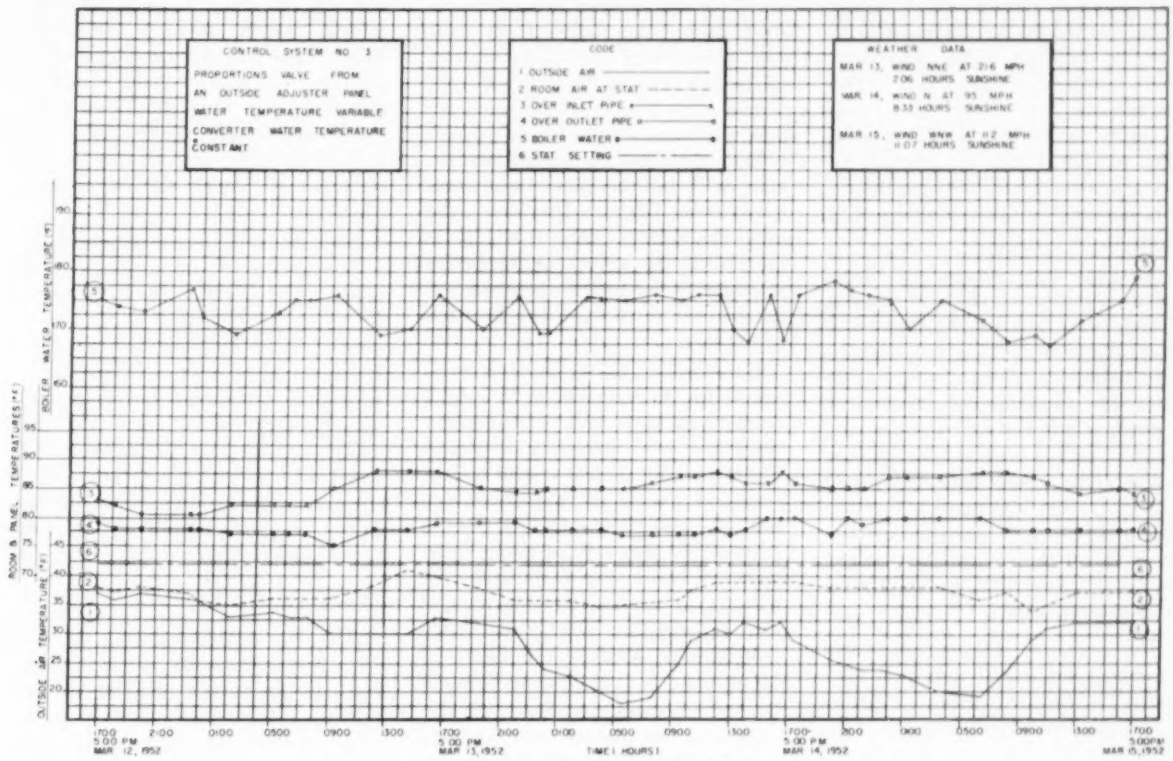

CONTROL SYSTEM NO 1
PROPORTIONS VALVE FROM AN OUTSIDE ADJUSTER PANEL
WATER TEMPERATURE VARIABLE
CONVERTER WATER TEMPERATURE IS CONSTANT
CODE
1 OUTSIDE AIR
2 ROOM AIR AT STAT
3 OVER INLET PIPE
4 OVER OUTLET PIPE
5 BOILER WATER
6 STAT SETTING
WEATHER DATA
MAR 13, WIND NNE AT 21.6 MPH
7.06 HOURS SUNSHINE
MAR 14, WIND N AT 9.5 MPH
8.33 HOURS SUNSHINE
MAR 15, WIND WNW AT 11.2 MPH
11.07 HOURS SUNSHINE
ROOM & PANEL TEMPERATURES (°F)
BOILER WATER TEMPERATURE (°F)
OUTSIDE AIR TEMPERATURE (°F)
TIME (HOURS)
5:00 PM MAR 12, 1952
5:00 PM MAR 13, 1952
5:00 PM MAR 14, 1952
5:00 PM MAR 15, 1952

Fig. 15—Temperature trends for Installation A

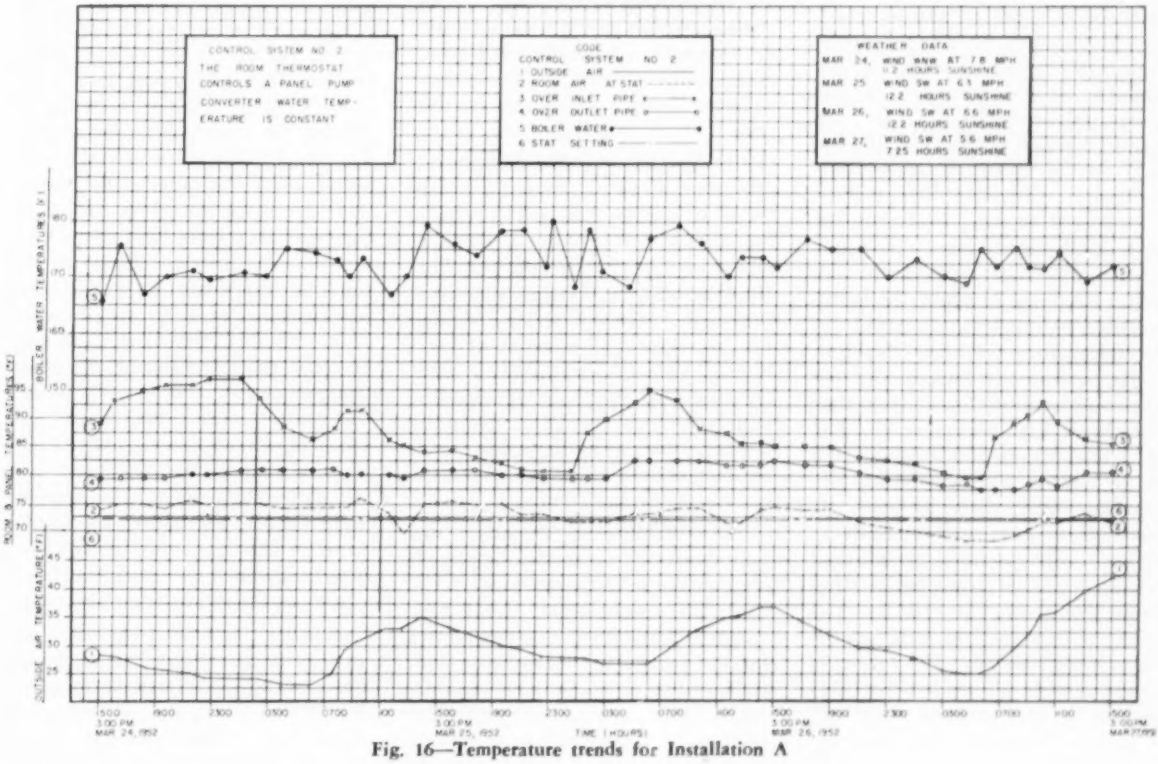

CONTROL SYSTEM NO 2
THE ROOM THERMOSTAT CONTROLS A PANEL PUMP
CONVERTER WATER TEMPERATURE IS CONSTANT
CODE
CONTROL SYSTEM NO 2
1 OUTSIDE AIR
2 ROOM AIR AT STAT
3 OVER INLET PIPE
4 OVER OUTLET PIPE
5 BOILER WATER
6 STAT SETTING
WEATHER DATA
MAR 24, WIND WNW AT 7.8 MPH
11.2 HOURS SUNSHINE
MAR 25 WIND SW AT 6.1 MPH
12.2 HOURS SUNSHINE
MAR 26, WIND SW AT 5.6 MPH
12.2 HOURS SUNSHINE
MAR 27, WIND SW AT 5.6 MPH
7.25 HOURS SUNSHINE
ROOM & PANEL TEMPERATURES (°F)
BOILER WATER TEMPERATURE (°F)
OUTSIDE AIR TEMPERATURE (°F)
TIME (HOURS)
3:00 PM MAR 24, 1952
3:00 PM MAR 25, 1952
5:00 PM MAR 26, 1952
5:00 PM MAR 27, 1952

Fig. 16—Temperature trends for Installation A

tures shown on the strip-chart. These points, plotted on the curves in Figs. 7 to 16, indicate major deviations from equilibrium conditions. For convenience they have been connected by straight lines. The curves, when compared with the original recorder charts, clearly indicate the results obtained without plotting each point.

The test data recorded are identified by a numbered circle at the end of each curve and may be checked against the code which appears on the right hand side of the chart. In the charts for installation *A* the number 5 which is noted as boiler water temperature on the code is actually converter water temperature. It would be well to note that number 6 represents the setting of the space thermostat and not the control point which may vary according to calibration or degree of load.

The operation of control system number 1 for installation *B* is illustrated in Fig. 7. For the period 6:00 p.m., December 15 to 7:30 a.m., December 16, the space temperature was well below the control point setting as a result of the low outside air temperature. The reset temperature of the boiler water, as determined by the ratio set on the indoor-outdoor controller, was not attained because of the excessive demand on the boiler; however, with the rise of the outside temperature to 14 F at 2:30 p.m., December 16, the demand allowed the boiler water to attain the reset temperature. A similar condition in which the boiler is unable to supply the demand exists immediately following the drop in the outdoor air temperature for the period from 5:30 p.m., December 16 to 10:00 a.m., December 17. For the remaining period covered, the rise in outside air temperature permits the boiler water to reach its reset value and supply heat as needed. This condition is indicated by the decreased temperature drop across the panel. Due to the preceding cold period, the wall temperatures were lowered. The following rise in outside air temperature lowered the reset temperature of the boiler water. These two conditions account for the lowered space temperature during the period from 2:30 p.m., December 17 to 2:30 p.m., December 18 because the cold walls absorbed more heat from the room air than was being supplied by the panel.

The operation of control system number 3 for the same installation is shown in Fig. 8. This shows the same condition as shown in Fig. 7, concerning the ability of the boiler to maintain the boiler water temperature at the reset value as a function of the load.

In addition, the outdoor thermocouple for this installation is located on the west wall, and thus does not sense the solar effects until almost mid-day. The control system is consequently unable to compensate for the solar effects in sufficient time to prevent the space from being overheated. This effect is illustrated in the period covered by Fig. 8 and can be seen by noting the space temperatures between the hours of 10:00 a.m. to 3:30 p.m. on January 31.

During the period of 4:00 p.m., January 31 to 7:00 a.m., February 1, the space temperature continues to exceed the thermostat setting, since the recirculated water from all zones to a common return is at a greater temperature than is required by this zone.

Fig. 9 illustrates the intermittent operation of the circulator for installation *C* during a period in which the outside temperature is continually changing. For comparison, Fig. 10 illustrates the continuous operation of the circulator under a similar load condition. Observation of Figs. 9 and 10 shows: *First*, that the temperature drop across the panel is less with continuous circulator operation; *Second*, that a more stable room air temperature exists with continuous circulator operation.

Since stability of the room dry bulb temperature can also be considered as the criterion of control, the room air temperatures of all four zones in installation *C* were plotted for the control system utilizing both reset and fixed boiler water temperature. These two control systems are presented for comparison in Fig. 11 and Fig. 12. Fig. 12 illustrates the control system utilizing the fixed boiler water temperature and reveals the fact that as the outside temperature fluctuates, wide variation in the space temperature results. Figs. 13 and 14 illustrate performance of installation *A* under similar control conditions.

Figs. 15 and 16 are presented as a comparison of proportioning and on-off valve operation for installation *A* which is classified as a heavy panel, heavy building construction. Examination of the two charts shows very little fluctuation in panel surface temperature, although Fig. 16 reveals considerable fluctuation in the panel inlet water temperature. This illustrates the damping effect of the heavy concrete slab with the coil buried deeper than normal.

Conclusions

The data gathered during the last two years, although not complete, have led to certain definite conclusions. The foremost of these is the importance of the proper design and installation of the basic heating system. An illustration of this point is the fact that in installation *B* the returns for all six zones were gathered together and mixed in a common return before any recirculation through the three-way mixing valves. This meant that frequently the temperature of the recirculated water was higher for the given zone than the heat loss from that zone warranted. The adverse effects of this condition are shown in Fig. 8 during the hours of 4:00 p.m., January 31 to 8:00 a.m., February 1. It may be noted that even though the space temperature is considerably above the control setting, inlet panel surface temperature and the outlet panel surface temperature are both well into the heating range and a temperature drop is still shown across the panel. This condition could have been eliminated by complete segregation of the return from each zone.

Another phase of basic panel design is further illustrated in installation *B*, where it may be noted in Fig. 7 that the space temperature is below the control setting except

where outside air temperatures permit the boiler to supply sufficient heat. One of the major factors which determines the ability of the heating system to maintain a desirable temperature level within a space is the selection of a boiler with sufficient capacity and recovery rate to satisfy the heat demand under the most severe conditions.

Another consideration in the successful operation of any control system is the selection and location of the various control elements. One of the control elements, the location of which is of vital concern, is the outdoor thermostat. The most effective location of this element cannot be categorically stated for any installation until consideration has been given to the type of construction and local climatic conditions. The outdoor thermostat should be so located as to sense the same prevailing climatic conditions as are affecting the space being controlled. For any installation whose exposed surfaces have a high percentage of glass area, the location of the outdoor thermostat for sensing the solar effects is especially important. Installation *B* illustrates the result of the inability of the outdoor thermostat to sense the solar effects. This is shown in Fig. 8. During the daylight hours of January 31, in which there were only 9.05 hr of sunshine (100 percent of that possible), the early solar effects were not sensed by the outdoor thermostat in sufficient time to prevent overheating of the space.

One means of achieving stable space temperature in buildings classified as being of light construction is the continuous operation of the circulator, regardless of outside air temperature fluctuation. Intermittent circulation with its associated hot and cold surges of water causes large panel surface temperature cycles which in turn affect the space temperature. The performance of a control system utilizing both continuous and intermittent circulation in this type of installation is exemplified in Fig. 9 and Fig. 10 for installation *C*. These figures indicate that, for operation under the same general load conditions, a control system utilizing the continuous circulation affected more stable space temperature control.

In a control system which employs reset action, the boiler water temperature is adjusted upward or downward a predetermined amount for each degree drop or rise in the outside air temperature. This type of control system permits more desirable stable control of the heat supplied to the space than would a control system using a constant boiler water temperature setting. This fact is illustrated in Fig. 11 and Fig. 12 for the operation of the two control systems in installation *C* under the same general load conditions. A further illustration of this fact as brought out in the operation of the control system for installation *A* is shown in Fig. 13 and Fig. 14.

Installation *A* was the only one of the three installations which utilized both on-off and modulating valve action. It is noted by reviewing Fig. 15 and Fig. 16 that for similar load condition there is relatively no difference in the stability of the space temperature. This fact can possibly be accounted for by the large mass of the concrete panel.

In conclusion it may be said that the continuation of this field test program will provide additional, definite conclusions on the application of automatic temperature controls to floor panel heating systems.

Acknowledgment

The authors wish to thank the Barber-Colman Co., Rockford, Ill. the Johnson Service Co., Milwaukee, and the Minneapolis-Honeywell Regulator Co., Minneapolis, for the controls which they provided and the assistance and counsel they rendered. The authors also thank J. R. Rush, Research Assistant and R. R. Head, Research Fellow at the University of Minnesota, who rendered valuable service during this project.

JUNE 29-30, JULY 1

are the dates of the

ASHVE SEMI-ANNUAL MEETING 1953

to be held in

DENVER, COLO.

Your hosts will be the Rocky Mountain Chapter

COMMITTEE ON ARRANGEMENTS

Fred Janssen
General Chairman

B. H. Spurlock, Jr.
Honorary Chairman

Honored by Life Membership

JOSEPH A. CUTLER — President and General Manager, Johnson Service Co., Milwaukee, Wis. Following a three-year period as instructor at the University of Wisconsin, from whose engineering school he was graduated in 1909, Mr. Cutler joined Johnson Service Co. as a sales engineer in 1912. He served in the Kansas City, Dallas and Chicago offices of the company until

J. A. Cutler
Milwaukee, Wis.

1923, with the exception of a period of service with the Army during World War I. Mr. Cutler was branch and district manager in Chicago from 1923-35 and became vice president and director in 1928. After seven years as general sales manager for the company, he was promoted to his present position in 1938.

A member of the Society since 1916, he served on the Council from 1920-26 and on numerous Society committees. He was president of the Illinois Chapter in 1922. Mr. Cutler numbers among his clubs the Rotary, International, the Milwaukee Association of Commerce, Milwaukee Athletic Club and the University Club of Milwaukee. He has been active in University of Wisconsin affairs, serving on the Athletic Board, the Executive Committee of the University of Wisconsin Foundation, and as past president of the General Alumni Association.

●

FRANK A. SHEPPARD — Johnson Service Co., Kansas City, Mo. Mr. Sheppard became a Life Member recently, 34 years after having joined the Society in 1918. He was president of the Kansas City Chapter in 1919 and has served on many Chapter Committees.

Mr. Sheppard has been with the Johnson Service Company since 1914. Following a brief period in the company's Milwaukee office, he was transferred to the Kansas City sales office, where he has been located since, engaged in the design and installation of pneumatic temperature control systems.

●

EDGAR O. MARTY — Project Engineer, Orinoco Mining Co., a U. S. Steel subsidiary, located in Venezuela. Mr. Marty's business experience encompasses a variety of activities. His

E. O. Marty
New York, N.Y.

career began with F. F. Van Tuyl, Consulting Mechanical and Electrical Engineer, from 1910 to 1920, where he designed power plants, industrial projects, schools, hospitals, etc. In 1920 he moved to Pottsville, Pa., and served as administration and engineering head of the Sherman Coal Corp. and Indian Head Anthracite, Inc., where his engineering encompassed mine ventilation, pumping water supply, colliery building heating and ventilating, etc. From 1938 to 1942 he was chief mechanical and electrical engineer for the Pennsylvania Turnpike Construction. In 1942 he became associated with Parsons, Brinckerhoff, Hall and MacDonald of New York, and had supervision of U. S. Army Bases in the Caribbean.

Recent projects he has been associated with include the Itabira Iron Ore Project at Itabira, Brazil, and coal mining operations in Turkey. Mr. Marty joined the Orinoco Mining Co. in 1950.

Mr. Marty joined the Society in 1916 and was a charter member of the Michigan Chapter founded that year. Born in Detroit in 1887, he graduated from the University of Michigan in 1910 with a B.S. in Mechanical Engineering. He received his M.E. degree from the same school in 1932. A registered professional engineer in New York and Pennsylvania, Mr. Marty is a member of the AIEE, AIME, ASME, and the Society of American Military Engineers.

●

MILTON S. SMITH — Vice President and Treasurer, Buensod-Stacey, Inc., New York, N. Y. In cooperation with thirteen other associates, he formed Buensod-Stacey in 1935. Prior to this time, Mr. Smith had been with Buffalo Forge Co. (1908-1916), and the Carrier Corp. from 1916-1935. While with the latter firm he served variously as production manager, New York office

M. S. Smith
New York, N.Y.

vice president in charge of production, and treasurer.

Mr. Smith was born in Nicholasville, Ky., and graduated from the University of Kentucky with a B.S. in Mechanical Engineering in 1908. He has been a member of the Society since 1919. He is a registered professional engineer in New York and New Jersey, his company's representative in NAM, and a member of Tau Beta Pi and the Rotary Club of New York.

PIERCE TIMMIS — Industrial Engineer, United Engineers and Constructors. Mr. Timmis, recently honored by elevation to life membership in the

Pierce Timmis
Philadelphia, Pa.

Society was born in Crewe, England in 1887. He graduated from the Mechanics Institute there, and the Grosvenor School of Science and Art in Chester, England. He has been associated with several firms as a designing engineer since coming to this country in 1909. Among these have been Westinghouse Church, Kerr & Co., and Dwight P. Robinson & Co. Inc., both of New York.

Mr. Timmis, in his present position in Philadelphia, has charge of engineering work for heating, ventilating and air conditioning, as well as plumbing, piping and allied fields. He had designed such systems for industrial buildings, hotels and hospitals among others, in Canada, Brazil, Argentina and our own country.

•

HARRY S. WHELLER — President and General Manager, L. J. Wing Manufacturing Co., Linden, N. J. Born in London, England, Mr. Wheller came to this country at an early age and received his education in the New Jersey public schools. A member of the Society since 1916, he was presented his Life Membership Certificate at the December meeting of the newly formed North Jersey Chapter of the Society, the first member of the Chapter to be so honored.

Mr. Wheller has been with the L. J. Wing Manufacturing Co. since 1902 and has served successively as secretary, vice president, and since 1942 as presi-

H. S. Wheller
Linden, N.J.

dent and general manager. He has been responsible for the invention and design of many of the company's products.

Active in the Society and the New York Chapter he most recently served on the Committee on Arrangements for the Semi-Annual Meeting, 1952, held at Spring Lake, N. J.

NORTH JERSEY MEMBERS MEET

• *NORTH JERSEY*: Various Committee reports were made at the November meeting, one of which was made by C. H. Smith, chairman, program committee. As a part of this report, P. B. Gordon, president of the New York Chapter made an excellent presentation of the objectives and membership advantages of ASHVE, and outlined what the Society has accomplished since its inception.

O. O. Oaks, chairman of the nominating committee, submitted a slate of officers for the coming year. The following were unanimously elected: *President*—F. H. Faust; *Vice President*—H. M. Patrick; *Secretary*—C. H. Smith; *Treasurer* — W. C. Kruse, Jr.; *Board of Governors*: E. T. Best, M. C. Christesen, and O. O. Oaks.

Pres. F. H. Faust then mentioned the very excellent and helpful work performed by H. P. Morehouse throughout the preliminary and formative period in establishing the chapter. He then announced the following standing committees: *Program* — H. M. Patrick, chairman; *Membership* — G. C. Norman, chairman; *Publicity* — M. C. Christesen, chairman; *Attendance* — S. H. Nitzberg, chairman. It was mentioned that two additional committees, one on special events and the other on nominations, would be appointed later.

Mr. Faust then asked A. V. Hutchinson, Executive Secretary of ASHVE, to say a few words and introduce the new officers and the members of the board of governors. Mr. Hutchinson's talk on Society affairs was well received and highly appreciated. Attendance 45.

P. B. Gordon, president of the Society's second oldest Chapter looks on as A. V. Hutchinson, executive secretary of ASHVE, presents Chapter Record Book to F. H. Faust, president, North Jersey Chapter, the Society's newest

Summary of Chapter Meetings*

• *ARKANSAS*: F. L. Cumnock introduced the guest speaker of the evening, Lewis Houston, chief engineer of Bell and Gossett Co., Morton Grove, Ill. Mr. Houston gave an interesting talk on *Pumps And Their Selection*. He stated that most pumps were oversized by the designing engineer. He added that the average life of hot water circulating pumps was from seven and one-half to ten years. A discussion period followed the talk.

Pres. E. N. Pettit called the December meeting to order at the Albert Pike Hotel. J. C. Lewis, chairman of the entertainment committee reported on the plans for the Christmas party.

J. L. Brown was selected as alternate on the Chapters Conference Committee for the Annual Meeting in Chicago. An auditing committee was appointed by Mr. Pettit consisting of J. L. Coplin, chairman, G. W. Tompkins and R. S. Hill. Attendance 18. Attendance ratio 0.25.

• *ARKANSAS*: E. K. Campbell, president of Campbell Heating Co., and Life Member of the Society, was guest speaker at the November meeting. Mr. Campbell, who is a pioneer in the warm-air heating industry, chose as his topic *Air Movement and Warm Air Heating*. He pointed out that the purpose of all heating and air conditioning is to help the human body regulate its heat loss. The discussion included various applications and types of warm-air heating systems. After Mr. Campbell's talk, an interesting question and answer period followed.

The meeting, which was held at the Albert Pike Hotel, was called to order by Vice Pres. Herman Cumnock. J. W. Thompson made a motion, which was seconded by J. C. Lewis, that another meeting place be investigated. Attendance 23. Attendance ratio 0.30.

• *ATLANTA*: The following officers were elected for the coming year: *President*—J. G. Croley; *Vice President*—J. M. Lazenby; *Secretary*—T. A. Barrow; *Treasurer*—Peter Van Dae, Jr.; *Board of Governors*—F. A. Player and E. K. Jamison.

J. S. Edgar, chairman of the program committee, announced the program for the evening which featured a humorous talk on big-time football delivered by Coach Bob Fumble, known as *Sweet Ole Bob*, of Siwash College, who in reality was Warren Foster, Coca-Cola Co. This was followed by a musical presentation by a group of Georgia Tech students known as *The Fowler Street Five Plus One*.

In the absence of Pres. F. A. Player, J. G. Croley presided over the December meeting which was held at Mammy's Shanty Restaurant. Attendance 44. Attendance ratio 0.40.

• *ATLANTA*: The October meeting, which was called to order by Vice Pres. J. G. Croley, was held on November 10 at Mammy's Shanty Restaurant.

J. S. Edgar introduced the speaker of the evening, J. W. May, technical director, Air Filter Div., American Air Filter Co., Louisville, Ky. Mr. May discussed the applications, approximate unit costs, and the history of the development of the various types of mechanical and electrostatic air filters. He illustrated his talk with slides.

Mr. Edgar reported that plans were under way for the December social meeting. W. M. Garrard, chairman, nominating committee, reported the slate of nominees for chapter officers for the 1952-1953 year. H. K. McCain moved that the nominations be closed, and J. S. Edgar seconded the motion. Attendance 45. Attendance ratio 0.40.

• *BALTIMORE*: G. M. Heslop introduced the guest speaker of the evening, Henry Wright, Moline, Ill., formerly managing editor of the *Architectural Forum* and technical editor of the *Architectural Record* and technical consultant for Herman Nelson Products, American Air Filter Co., who spoke on the *Fundamentals of School Heating and Ventilating*.

Mr. Wright stated that investigations and tests were conducted on typical classrooms of a midwest modern single-story school, using automatically controlled unit ventilators. He also stated that the peculiarities of the classroom requirements are: intermittent use; occupancy coinciding with time of maximum solar gain; density of occupancy; and special lighting requiring thermal control.

He further stated that the data were accumulated for a complete heating season, with 10,000 temperature readings taken daily. The following test equipment was used: globe thermometers, for obtaining resultant temperatures near to the sensitive reception of the human body; electronic temperature recorders; thermopiles for apparent radiative temperature; apparatus for recording solar gains; and instruments for measuring air velocities, air movements, patterns and humidity. All of the data were tabulated and charts were drawn to show when heating and cooling were required, and the solar influence on each. One of the basic conclusions drawn by Mr. Wright

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

was that the modern, single-story school, with its increased natural light, increases need for classroom cooling during cold weather and need for individual classroom temperature control.

Pres. E. R. Kent called this December meeting to order at the Engineer's Club. Attendance 41. Attendance ratio 0.30.

• *CENTRAL OHIO*: R. B. Engdahl, research engineer, *Battelle Memorial Institute*, Columbus, was speaker for the evening. Mr. Engdahl gave a talk on the history and work of the Institute.

The November meeting was held at the Fort Hayes Hotel. R. S. Curl made the motion that Pres. A. D. Bogen and Vice Pres. N. T. Hess represent the chapter at the Annual Meeting in Chicago in January. The motion was seconded by R. H. Smith and passed. It was also decided at this meeting not to have a December meeting. Attendance 25. Attendance ratio 0.24.

•*CINCINNATI*: E. A. Sobolewski introduced the speaker of the evening, F. C. Oliver, Carrier Corp., who gave an excellent talk on absorption units in air conditioning. Mr. Oliver illustrated his talk with slides.

The December meeting was called to order by Pres. H. E. Russell at the Engineering Society Headquarters. After the minutes of the November meeting had been read and approved, T. D. Reiley reported that the membership committee was working well and asked that all members make every effort to cooperate with the membership committee to secure new applicants.

C. P. Krantz gave a vivid description of the annual Christmas party to be held. H. W. Moore, chairman of the publicity committee reported that the committee is almost ready to begin printing the new roster of all members of the chapter. Mr. Russell was elected member on the Chapters Conference Committee with R. C. Beineke as alternate. Attendance 51. Attendance ratio 0.40.

• *CINCINNATI*: J. F. McCarty of Lockland gave a talk on the development of jet engines, which claimed the close attention of all the attending members. Along with his talk, Mr. McCarty showed films on the development of the jet engine up to the present time.

The November meeting was called to order by Pres. H. E. Russell after which various committees presented their reports. Attendance 34. Attendance ratio 0.20.

• *CONNECTICUT*: C. J. Wahnquist reported the following as new members in the Connecticut Chapter: J. P. Lægnos, J. D. Burgess, W. J. Parker, John Reed, J. O. Ostberg, R. P. Tucker and Donald Scott.

D. M. Hummel introduced the speaker of the evening, Douglass Orr, architect and consultant on the White House reconstruction. Mr. Orr spoke fully and interestingly on the work which was performed there.

The November meeting, held at the Three Cups Inn, was called to order by President T. L. Arnold. Attendance 71.

• *DELTA:* It was learned at the November meeting that there were six new members in the Delta Chapter. Ralph Elizardi, in the absence of C. B. Gamble, reported that the new model By-Laws were reviewed and approved by the board of governors and the legislative committee. Mr. Elizardi explained how the new by-laws, a copy of which was mailed to every member, differed from the existing by-laws. G. E. May motioned that the new model by-laws be adopted, the motion was seconded by R. B. Guest, and passed by acclamation.

Election of J. S. Burke as member and Walter Cooke as alternate member of the Chapters Conference Committee was by acclamation.

L. R. Maxwell introduced the speaker of the evening, Ernest Szekely, president of the Society and president, Bayley Blower Co., Milwaukee. President Szekely presented an interesting and most informative discussion on *Fans, Their Design and Application*.

The meeting, held in the Trophy Room of the New Orleans Athletic Club, was called to order by Pres. Walter Cooke. Attendance 37. Attendance ratio 0.30.

• *GOLDEN GATE*: The November meeting, held at the Capitol Inn and Motel, was a joint meeting of the Golden Gate Chapter and the Sacramento Valley Chapter. After Pres. L. A. O'Meara extended a welcome to both groups, the meeting was turned over to Pres. T. J. White of the Golden Gate Chapter.

Mr. White then introduced N. H. Peterson, a member of the Council, who gave a brief history of the interesting background of J. D. Kroeker, treasurer of the Society. Mr. Kroeker outlined the history of the formation of ASHVE, with a review of the activities, operation and objectives, and concluded with a presentation of the Charter for the Sacramento Valley Chapter to Mr. O'Meara.

In his acceptance of the Charter, Mr. O'Meara expressed his heartfelt thanks and concluded by extending best wishes to the Society through Mr. Peterson and Mr. Kroeker.

Mr. White then presented Mr. O'Meara with a gavel from the Golden Gate Chapter as a gift to the Sacramento Valley Chapter. Mr. Peterson then presented J. E. Marshall with a Sacramento Valley Chapter Minute Book and Kardex file.

The meeting was turned over to E. C. McKinsey, Sacramento Valley Chapter program chairman, who introduced Henry Wright, Moline, Ill., technical consultant, Herman Nelson Division of American Air Filter, who spoke on problems, and research done in school installations as they related to five factors of comfort in classroom heating and ventilating. Attendance 154.

• *ILLINOIS*: Speaking before the December meeting of the Illinois Chapter, C. M. Wilson, general sales manager, Anemostat Corp. of Ameri-

ca, New York, N. Y., stated that, in his opinion, high velocity air distribution systems represented a distinct trend. In fact Mr. Wilson believes that within two years virtually all air conditioning installations of 75-ton size or larger will incorporate high

C. M. Wilson

velocity, high pressure air distribution systems.

Mr. Wilson described high pressure, high velocity systems as those which generally require the use of special devices for the attenuation of sound and dissipation of pressure and velocity near the air outlets. After showing slides of various types of diffusers, he described a high pressure, high velocity diffuser as essentially a conventional diffuser with a damping device to reduce pressure, velocity and sound.

After demonstrating how the use of velocities higher than those used in conventional systems results in smaller duct sizes, he said that this type of system includes savings in space required for duct work; in duct material and cost of duct work; in multi-story buildings savings in floor heights and the elimination of much *butchering* of existing buildings in order to install air conditioning.

Mr. Wilson stressed the fact that the advantage to the contractor is that smaller ducts result in reduced labor costs so that a higher percentage of the total job cost is in connection with material and equipment having readily determined costs. He mentioned the relatively higher fan operating costs and urged the members not to go overboard on velocities. In his opinion, reasonable maximum velocities in the average high pressure, high velocities systems are from 3600 to 4000 fpm. However, circumstances often permit velocities up to 6500 fpm.

After Mr. Wilson's talk there was a lively question and answer period, during which both Mr. Wilson and N. E. Bueter stressed the fact that high velocity, high pressure systems are equally suitable for ventilating systems — particularly where noise problems are not important factors, as in boiler rooms. Attendance 87. Attendance ratio 0.60.

• *ILLINOIS*: Mr. Richard March, staff assistant in the reactor division of the Chicago operations office of the Atomic Energy Commission, gave a most interesting talk entitled *Nuclear Energy Cannot Compete in Near Future With Established Industrial Fuels.* Mr. March pointed out advances in the field of atomic energy have been outstanding and industrial applications are now receiving a great deal of attention. Radioactive cobalt is now used in connection with welding inspections, and other isotopes are being used as tracers in oil pipe lines. He further stated nuclear energy has been, and is being used for generation of power. Naval vessels, particularly submarines, Mr. March said, are being built which will incorporate nuclear reactors. He stressed that it is one thing to produce power by nuclear fission, another to do it economically.

He explained that one pound of uranium is equivalent to 1300 tons of coal as a heat source, also that a nuclear reactor provides a controlled chain reaction and that a breeder reactor is one which produces more fuel than is consumed. A breeder reactor using uranium produces plutonium (a fissionable material) and heat, Mr. March said, which can be used for the generation of power.

Mr. March also stated that the industrial feasibility of nuclear power depends upon many factors and in his opinion such power cannot compete now or in the near future with established industrial fuels unless the plutonium produced is sold to the government for its military value. He said our estimated future power consumption makes it necessary that a fuel substitute be found, and for this reason he believes that the most important long range problem in the nuclear energy field is the economical production of power for commercial and industrial use.

Mr. March also pointed out that in the operation of a reactor, the cost of uranium is a negligible part of the total cost, so that fuel costs, fuel savings and thermal efficiencies are not too important. For this reason he does not believe that it will be necessary to produce power by

Richard March

means of high temperature, high pressure steam which requires the use of relatively expensive piping alloys.

The November meeting, held at the M & M Club was called to order by Pres. M. W. Bishop. After dinner various committees made their reports. Attendance 107. Attendance ratio 0.20.

• *IOWA*: At the November meeting R. S. Stover announced that an invitation was received from the *Iowa Engineering Society* inviting the Iowa Chapter to have their February meeting in connection with their annual convention, Feb. 10 and 11. Program Chairman J. F. Sandfort is to work out this suggestion with Professor Black of Iowa State College.

Pres. R. H. Schnell called the meeting to order at the Standard Club. Attendance 32. Attendance ratio 0.40.

• *MEMPHIS*: At the November meeting J. W. McIntosh, treasurer, announced that dues for 1952-53 are

due. In this connection J. S. Mitchell suggested the chapter print and issue dues cards as evidence of payment of dues.

C. S. Fischer, member of Chapters Conference Committee, reported he had received a questionnaire regarding establishing of special branches for three years, which would later become chapters after they had proved themselves as special branches. On the motion of Roy Johnson, seconded by C. E. Wynn, Mr. Fischer was left free to answer the questionnaire.

M. H. Ellis, Jr., chairman of the Meetings Committee, introduced the speaker of the evening, Ernest Szekely, president of the Society, and president of Bayley Blower Co., Milwaukee. Mr. Szekely spoke of *Pneumatic Conveying*, which he illustrated with slides. The subject presented many interesting angles and Mr. Szekely answered questions which the members raised.

Pres. W. L. Drake called the meeting to order at the King Cotton Hotel. Attendance 48. Attendance ratio 0.40.

• *MIAMI VALLEY*: At the November meeting C. D. Weaver's nomination of D. L. Bergman to serve as a member of the Chapters Conference Committee was approved, with R. J. Perkins as alternate.

Treas. R. W. Kimmel reported the balance as of November 1, 1952 to be $89.11. After guests were introduced, plans for the Christmas party were discussed.

J. M. Schweiger introduced the speaker of the evening, Mr. Pelz, Republic Steel Corp. Mr. Pelz presented a very interesting movie showing the manufacturing and application of electronite metal tubing. Attendance 22. Attendance ratio 0.24.

• *MONTREAL*: Pres. W. G. Hole called the November meeting to order at the Berkeley Hotel. A number of the committee chairmen made reports on their activities. R. S. Libby introduced the speaker of the evening, Commander K. P. Farrell, R.C.N., who was accompanied by Commodore Baker, R.C.N.; Captain Freeborn, R.C.N.; and Captain McGillvery, R.C.N. Commander Farrell illustrated his most informative and interesting discussion with slides. Attendance 50. Attendance ratio 0.40.

• *NEBRASKA*: Blake Ward, field service engineer, A. M. Byers Co., St. Louis, Mo., spoke on *Snow Melting Systems*. After introductory remarks, Mr. Ward presented a color, sound motion picture entitled *A Winter Wonder* which illustrated the topic of the evening. Following the picture the speaker discussed the merits of snow melting systems. A question and answer period followed the discussion.

Pres. S. W. Black called the December meeting to order at the Omaha Room of the Castle Hotel. Attendance 44. Attendance ratio 0.20.

• *NEBRASKA*: Dr. Paul C. Goetz, Refinite Corp., spoke on *Our Waters and Their Treatment* at the November meeting. Dr. Goetz then presented a paper on the practical needs of water treatment in this locality. He distributed data sheets for the use of the members showing general geographic characteristics of water treatment needs over the entire United States. Dr. Goetz also spoke of boiler water treatment corrosion aspects and many other problems. A question and answer period followed the discussion.

After Pres. S. W. Black called the November meeting to order at the Omaha Room of the Castle Hotel, he called on Secretary H. H. Ulrich to read a letter addressed to the chapter from Brig.-Gen. W. E. Potter, Division Engineer, U. S. Army, relative to the urgent need by the army for engineers qualified in various branches. Attendance 17. Attendance ratio 0.13.

• *NEW YORK*: Vice Pres. J. E. Schechter introduced the speaker of the evening, W. E. Hood, Carrier Corp. The subject of Mr. Hood's discussion was *Residential Year 'Round Air Conditioning*.

He stated some features of the system were: (1) reduction of heat loss or gain due to use of fixed windows or elimination of windows in walls where views were not important; (2) cleanliness; (3) flexibility of room temperature control; (4) ability to use inside rooms as effectively as outside rooms; (5) elimination of screens and screen doors; (6) greater freedom for the architect as he could omit breeze-ways, porches and windows and make good use of inside rooms; and (7) possibility of using land plots to best advantage as window views would be less important — would be able to locate rooms in any position without regard to need for window space.

Mr. Hood then explained the problems involved in selecting and assembling various parts of heating and cooling equipment to make a complete system, as compared with installing a factory assembled combination heating and cooling unit.

In the discussion, some of the questions dealt with air quantities, temperature drop, refrigerants, size of units, coil and heater design, and heat transfer rates for the heating surface.

The November meeting was held in the Building Trades Club, and was called to order by Pres. P. B. Gordon. Attendance 120. Attendance ratio 0.30.

• *NORTH TEXAS*: The December meeting consisted of a dinner dance held at the Lakewood Country Club. The party was successful from every standpoint, including financial, and each lady was given an orchid corsage as a favor.

Pres. R. E. Allison appointed a special committee to count the election ballot returns, and the following members were elected to serve next year: *President*—P. N. Vinther; *Vice President*—M. W. Brown; *Secretary*—J. A. Ray; *Treasurer*— H. G. Gregerson; *Board of Governors*—R. E. Allison, J. L. Tye, and G. H. Meffert. Attendance 260.

• *NORTHEASTERN OKLAHOMA*: Program chairman J. N. Watt introduced C. S. Stock, general sales manager, Herman Nelson Div., American Air Filter Co., Moline, Ill. as speaker of the evening. Mr. Stock's discussion was *Laboratory School — A Scientific Evaluation of Comfort Conditions and Building Performance.* The talk was based upon an investigation of classroom heating and ventilating which was conducted during the 1951-52 heating season at a new school in Moline. Mr. Stock used slides to show instrumentation and charts of findings. An educational color sound film, *Design for Living,* which followed, showed the non-technical discussion of fundamentals of school heating and ventilating. A question and answer period followed Mr. Stock's talk, which was considered as one of the outstanding talks of the season.

Pres. C. H. Dollmeyer, Jr. called the November meeting to order at the University of Tulsa Student Activities Building. He then urged members to attend the Annual Meeting in Chicago in January. He then appointed an auditing Committee consisting of R. E. Pauling, chairman; J. D. Schubert, and T. E. Krieg. He reminded the members that a member and alternate member would have to be appointed to serve on the Chapters Conference Committee to attend the Annual Meeting. Attendance 35. Attendance ratio 0.60.

• *NORTHERN OHIO*: W. F. D. Neiheiser introduced Louis Smith, C. A. Dunham Co., who spoke on *Sub-Atmospheric Steam and Its Control.*

Mr. Smith discussed the general performance of steam heating systems and mentioned that the heating system comprises control equipment as well as the boilers, radiators and so forth, and that the complete installation must be considered as a whole. Because of the nature of steam heating systems, he explained, it is difficult to modulate their output at very low loads. He discussed the on-off systems and continuous systems in which the steam pressure is usually regulated by means of a control valve. He then spoke of the sub-atmospheric type system. He stated it was possible to obtain radiator temperatures as low as 133 deg as required for light loads and that partial filling is used to further reduce the radiator capacity.

W. M. Rowe took the floor to state that H. M. Nobis, Life Member, was present at the meeting on the first day of his retirement after 25 years of service at Warner and Swasey Co., Cleveland.

Mr. Neiheiser introduced D. Williams, CEI, who spoke on the subject of stocks and bonds and the mechanism of bond negotiation. After this, Treas. J. R. Venning reported an on-hand cash balance of $921.57 as of November 10.

Membership Chairman, H. R. Canoyer proposed D. V. Case, Jr. and R. J. Kaschyk for membership in the chapter. G. V. Parmelee then introduced D. J. Vild and Aydin Umur, newcomers on the ASHVE Research Laboratory staff.

Pres. R. E. Sherman called the November meeting to order in the Mather Room. Attendance 75.

• *NORTHERN PIEDMONT*: At the November meeting, the following slate was elected for the year of 1953: *President*—J. E. Hart; *Vice President*—R. B. Crosland, Jr.; *Secretary*—S. T. Oliver; *Treasurer*—L. R. Gorrell; *Board of Governors*: J. deB. Shepard and R. A. White.

Fourteen students attended this meeting. Prof. F. J. Reed introduced the students from Duke University while Mr. Knight introduced the North Carolina State students.

David M. Lawson, Sporlan Valve Co., was speaker of the evening. Mr. Lawson's discussion was on the *Design, Manufacture and Use of The Expansion Valve.* The talk was illustrated with slides and created quite a discussion.

Pres. L. L. Vaughan called the meeting to order at the Chez Gourmet Restaurant. After dinner the group went to Broughton Engineering Laboratory on the campus of North Carolina State College. Attendance 52. Attendance ratio 0.40.

• *ONTARIO*: N. W. Kingsland, chairman of *On-To-Chicago Committee,* outlined to the chapter the arrangements made for members.

To the amazement of all present, Santa Claus, alias A. G. Ritchie, appeared at the meeting and presented a multitude of gifts to the members and guests present.

The speaker of the evening was J. B. Johnston, York-Shipley, Inc., York, Pa. Mr. Johnston's talk, which was illustrated by slides, was entitled *Packaged Steam Generators.* One of the most interesting discussion periods the chapter has had, followed Mr. Johnston's talk.

Pres. J. H. Ross called the December meeting to order at the Royal York Hotel. Attendance 165. Attendance ratio 0.30.

• *ONTARIO*: One of the most informative and enthusiastic meetings that the Chapter has had for some time was held on November 3 at the Royal York Hotel.

Under the chairmanship of D. A. Stott there was a panel discussion on the subject of *What Do You Think Is Wrong With the Heating, Air Conditioning and Ventilating Business?* On the panel of experts to answer questions were: D. L. Angus and F. D. Ledgett, representing the engineers; M. C. Bailey and M. K. Bowman, representing manufacturers; J. A. Clifton and Mr. McMorran, representing wholesalers; and William Mould and Harry Thompson, representing contractors. The meeting lasted for an hour and three quarters and was at all times brisk.

Pres. J. H. Ross who called the meeting to order introduced the first lady member of the Ontario Chapter, Mrs. Madeline Hoare. Attendance 136. Attendance ratio 0.55.

• *OREGON*: A big turnout maintained record enthusiasm at the Heathman Hotel for the Oregon Chapter's November meeting.

Guest speaker, C. A. Pickett, Pacific Division Manager of American Air Filter Co., won top chapter interest with his discussion of the Moline, Ill. experimental school. The discussion pertained to the heating and ventilating discoveries in the classrooms. He explained the application of the recording type instruments used in this project and the unexpected results. Ably summarized by Mr. Pickett, the results of this study pointed out the need for more classroom cooling coupled with the desirability of individual room control. The density of the per capita use along with the solar heat gain factors led him to stress five prime considerations in classroom conditioning: a balanced thermal condition, quick heat for fast pick-up, outdoor air supply, outdoor air for cooling and two-way control.

Mr. Pickett's talk was well supplemented with many multi-colored slides which graphically illustrated the results obtained from this study. After the talk, the members participated in a vigorous discussion period.

The chapter was quite impressed when Pres. K. H. Hanson presented a beautiful bell given the chapter by the Swiss Special Branch in recognition of the gavel sent them by the Oregon Chapter members.

A secret ballot was cast by the Chapter to elect the nominating committee who will select officers for next year. Those named were: T. E. Taylor, chairman; B. W. Farnes, J. D. Kroeker, E. R. Lokey, and W. B. Morrison. Attendance 69. Attendance ratio 0.40.

• *OTTAWA VALLEY* — Pres. Bernard Stotesbury called the November 18 meeting to order at the Prescott Hotel. He then introduced visitors from the Montreal Chapter: H. G. S. Murray and F. G. Phipps. Other visitors who attended this meeting were Messrs. R. L. Collins, John Munro, S. Smith, A. Lawson, M. Chomyn, A. Burrell and H. Nault.

After a brief discussion it was decided that Vice-Pres. G. L. Ostiguy represent the Ottawa Valley Chapter at the Annual Meeting in Chicago in January. W. J. Robinson was selected as the alternate.

A copy of *Steam or Hot Water* was distributed to the members. They also received a copy of the draft of the Constitution and By-Laws.

Following a brief recess, a colored, sound film, entitled *Service Unseen*, was shown through the courtesy of Carrier Corp. Attendance 31.

• *PHILADELPHIA*: Past President M. F. Blankin introduced the guest speaker of the evening, Ernest Szekely, president of the Society and president of Bayley Blower Co., Milwaukee. Mr. Szekely presented an interesting talk, with slides to illustrate it, on *Fans — Their Design and Application*.

Pres. M. E. Barnard presided over the December meeting which was held at the Engineers' Club. The following new members were introduced: W. J. Sliney, J. M. Johnston, E. G. Carrier, H. N. Jacobs and E. L. Sederholm, Jr. After this G. W. Powell, Jr. presented a Life Membership Certificate to Pierce Timmis. John Everetts, Jr. gave a report on the Chicago Meeting and on train reservations. Attendance 80. Attendance ratio 0.23.

• *PHILADELPHIA*: Henry Wright, consultant to Herman Nelson Division, American Air Filter Co., gave an inspirational and informative talk on *The Laboratory School*.

After Pres. M. E. Barnard called the November meeting to order at the Engineers Club, the following names of new members were read: H. M. Olsen, C. A. Rhea, and R. V. Smith. Attendance 83. Attendance ratio 0.40.

• *SACRAMENTO VALLEY:* An educational slide-illustrated talk on *Electronic Combustion Safeguard Systems for Gas and Oil Burners* was given by Russell Green, sales engineer, Minneapolis-Honeywell Regulator Co. A discussion period followed the talk.

Pres. L. A. O'Meara presided over the December meeting. J. E. Marshall read a letter from the Sacramento Section of the *AIEE*. Its chairman, A. R. Tanner, invited the ASHVE members to attend a meeting at the Clunie Club House to hear Everett Lee discuss *What Is New In Science And Engineering*.

E. C. McKinsey, program chairman, reported on plans for future programs, one being a trip to the Folsom Dam site in the spring. D. R. Blanchard reported for the membership committee that eight new members had been accepted and that nine more applicants were being processed. R. A. Sarro, treasurer, stated a balance of cash on hand of $81.81. He also asked all members to fill out membership cards. J. E. Day of the attendance committee advised that badges will be available at the next meeting. Mr. McKinsey suggested that meetings would be more profitable if the members would bring up their special individual problems for discussion. H. D. Brainard moved that the chapter allocate $100 toward expenses incurred by the Chapters Conference Committee for the Annual Meeting in Chicago. Attendance 54. Attendance ratio 0.50.

• *SHREVEPORT:* W. E. FitzGerald introduced the speaker of the evening, W. D. Graham, manager, Trane Co., New Orleans. Mr. Graham presented an interesting and informative talk on *Selection and Application of Coils*.

In using steam coils, Mr. Graham said, a space velocity of 450-600 SPM was recommended for quiet operation, with velocities of 500-700 SPM for industrial applications where noise could be tolerated. For steam coils used in air conditioning work and particularly in packaged cooling units, he suggested a 500 SPM velocity. Single tube steam coils should be used where steam flow will not be modulated or an uneven temperature will result.

A formula was given for determining the number of rows in a hot water coil. This same formula applies for chilled water coils, with an addition of a wetted surface fac-

tor. It was pointed out that engineers and contractors have to take into account the fouling on the fins and inside of tubes and it is particularly important that they determine on what basis coil tables are presented with reference to the pressure drop through the coils. Some coil tables show the available external pressure after leaving the coil, thus taking into account the actual pressure drop to the coils. Other tables actually show the total pressure drop through the air handling unit.

The meeting was called to order by Pres. R. M. Hood at Monsour's Restaurant. A nominating committee, consisting of the following, was appointed: W. E. FitzGerald, P. O. Rottmann, C. M. Hadra, S. W. Beaty and Osborne Dyke, Jr. Attendance 34. Attendance ratio 0.40.

• *UTAH:* G. L. Soderborg, Sr., introduced the guest speaker of the evening, Dr. Lyle B. Borst, professor of Physics at the University of Utah. Dr. Borst discussed the problems of ventilation in atomic energy installations; more especially the installation at Brookhaven National Laboratories, Long Island, N. Y., in that he had been quite active in the direction of its design and construction. Dr. Borst further discussed the possibility of the University of Utah being the second in the country to construct a reactor of the non-secretive type, which he explained would be open to any of the industrial firms in the inter-mountain area to use as they saw fit. He gave a brief outline of the type of reactor that would in all probability be installed at the University if the finances and design are approved by the University's Board. Dr. Borst then opened the discussion to questions and answers and the group appeared to be quite enthused at the possibility of having such a reactor in this area. Dr. Borst then announced he would welcome industrial firms to participate in the project to the extent of participating in the design and possible methods of construction in that they were sadly in need of such help from outside sources to augment the limited assistance that can be secured from within the University itself.

Pres. D. R. Wilde opened the December meeting at the Hotel Newhouse. After various committees reported, Vice Pres. M. L. Gollaher advised that Mr. Wilde would not be able to attend the Annual Meeting in Chicago, and asked that an alternate be appointed. Attendance 25. Attendance ratio 0.40.

• *UTAH:* E. L. Baker, chairman of the Program Committee, introduced Jack Heath, the speaker of the evening. He gave an illustrated talk on *Bituminous Coal Industry in the United States*, with particular emphasis on how it affected the state of Utah.

The November 20 meeting was called to order by Pres. D. R. Wilde. Attendance 19. Attendance ratio 0.70.

• *WASHINGTON, D.C.:* After dinner at the November meeting, Pres. G. R. Walz presented past president pins to Past Presidents F. M. Thuney and S. R. Allen. Mr. Walz then announced that if the membership was having difficulty in obtaining rooms for the 59th Annual Meeting in Chicago, they should notify the Society.

N. M. Love, chairman of the Meeting Committee introduced the speaker of the evening, P. L. Geiringer, of the American Hydrotherm Corp., whose subject was *High Temperature Hot Water*. The popularity of the subject was evident from the large attendance, and Mr. Geiringer certainly did not disappoint his listeners. Mr. Geiringer compared the advantages of high temperature hot water over steam for heating purposes, particularly in long distribution systems. He stressed the greater heat storage capacity, and therefore the reduction in peaks, making the use of smaller boilers possible; and he stated that temperature controls are easier to accomplish, as varying velocities up to 300 fpm are practical, and the heat transfer may be varied by varying the velocity. Mr. Love also stressed lower maintenance costs, and the smaller danger from leaks. A lively question period followed his talk. Attendance 132. Attendance ratio 0.40.

• *WESTERN MICHIGAN:* R. W. Mangrum introduced the speaker of the evening, Prof. W. S. Harris of the University of Illinois, Urbana. His subject was *Radiant Baseboard Heating*. Professor Harris illustrated his talk with slides which outlined the development of radiator heating units, leading up to the radiator convector baseboard unit which was tested at the Research Residence at the University of Illinois. Professor Harris gave the performance data with the type RC baseboard installation. The cost of operation was shown to be approximately equal for Type R, Type RC and all small tube radiators. A cost study of a one-pipe system *vs.* a series system, which Professor Harris made, was presented and the results indicated that the installation cost of a one-pipe system is approximately one half that of a series system.

K. E. Robinson announced the second annual Industrial Ventilation Conference which will be held at Michigan State College, February 16-19, 1953, and invited all members to attend. J. T. Anderson reported on the committee which is making up a chapter handbook outlining the duties of chapter officers and committees.

Pres. H. R. Limbacher called the December meeting to order at the Battle Creek YMCA. Attendance 73. Attendance ratio 0.60.

• *WESTERN MICHIGAN:* The November meeting, held at the Hotel Rowe, Grand Rapids, was called to order by Pres. H. R. Limbacher. The speaker of the evening, J. H. Carpenter, Carrier Corp., Syracuse N. Y., spoke on *Psychrometric Charts*, which was further illustrated by the use of slides. A question and answer period followed the talk. Attendance 50. Attendance ratio 0.50.

• *WESTERN NEW YORK*: The speaker of the evening, G. V. Bond, Carrier Corp., gave an interesting talk, which he illustrated with slides, on the air conditioning installation at the Lever Brothers House in New York City. A very fine question and answer period followed the talk.

The November meeting, which was a joint meeting of the *ASRE* in conjunction with the ASHVE members of the Western New York Chapter, was held at the Park Lane Restaurant. Pres. J. M. Quackenbush thanked the *ASRE* for being host, and invited the group to be a guest at the meeting to be held by the ASHVE members. Attendance 80. Attendance ratio 0.60.

• *WISCONSIN*: N. E. Hill introduced the various speakers, who gave short twelve minute talks on the various phases of the automatic control industry.

The first speaker was H. Dale Cook, Perfex Corp., Milwaukee, who gave a talk on temperature control devices, limiting himself to a discussion of thermostats, due to the short time alloted his discussion.

The next speaker was J. A. Morrow, vice president, Shallcross Controls, Inc., Milwaukee, who spoke on pressure responsive devices, which he classified as the dry diaphragm type and the bellows type, as possible classifications. He also spoke of pressure responsive devices divided as to types with regard to the float (gasometer) type, and those which make use of *U* tubes.

The next speaker was H. W. Alyea, field engineer, Johnson Service Co., Milwaukee, who spoke on humidity responsive devices. He pointed out that relative humidity is controlled by any number of automatic control devices, which can be classified into two different categories. Mr. Alyea had a complete group of slides showing the various methods of securing humidification and also explained in considerable detail the difference between a 3-way mixing valve and a 3-way valve used for by-passing purposes.

W. F. Hoeser of Milwaukee Gas Specialty Co., Milwaukee, was the next speaker. He spoke on flame protection devices, and mentioned that there were many types of flame protection devices where the failure of the flame was detected by electronic devices, rod and tube types dependent on differences in expansion and contraction, liquid expansion types, thermo-electric types and those which make use of hot junction thermocouples.

The final speaker was Mr. Sloan of A-P Controls Co., who spoke on float control devices and limited his talk to those float control devices as used for vaporizing type of burners where a safety float control mechanism is very essential for safe operating conditions.

Pres. J. A. Lofte presided at the December meeting held at the E.S.M. Building. At the request of Mr. Lofte, C. H. Randolph made some comments concerning the revision of the present State Heating and Ventilating Code, which was last revised in 1935. Mr. Randolph pointed out that the Code Committee had already spent four afternoons studying the existing code. He emphasized the importance of each member becoming familiar with the code, and then to make recommendations as to where the code could be improved or revised to the general advantage of the heating and ventilating industry, as well as to the advantage of the building owners, occupants, etc. Attendance 103. Attendance ratio 0.30.

• *WISCONSIN*: Benjamin Spieth introduced John Hallema, staff architect for S. C. Johnson & Son, who discussed the preliminary planning of space requirements of the research laboratory. Mr. Spieth then introduced Roy Shields, Samuel R. Lewis Co., who was in charge of the design of the mechanical systems for the research tower as well as numerous other buildings.

Mr. Shields stated that the S. C. Johnson & Son office building was an unusual mushroom column of glass tubing walls and ceilings; the building being completed about ten years ago. The additions to this original building consisted of the research tower, the pilot plant, the garage and the office building which were finished about two years ago. His office designed the mechanical equipment for these additions. He then gave a brief outline of the means employed to provide the heating, ventilating and air conditioning in these buildings.

He stated that since Frank Lloyd Wright was the architect on the original building and the addition, they are far from the ordinary, and as a result it took an extreme amount of work and ingenuity to use ordinary mechanical equipment to fulfill the requirements and fit these into the space allowed in the unusual structure, as well as satisfying the exacting aesthetic requirements of the architect.

Mr. Shields discussed the mechanical equipment of the building; the tower; the exterior walls of each floor; the equipment room in the basement and the top of the tower houses, and many other aspects of the building. He then introduced C. E. Folwell, plant engineer, Johnson Wax Co., who arranged the group into parties. Each party was given a conducted tour through the research tower, pilot plant and office addition.

Pres. J. A. Lofte called the November meeting to order at the S. C. Johnson & Sons Plant at Racine, Wis. Various Committees made their reports.

J. E. Illingworth, chairman of the membership committee announced that E. R. Anderson had been advanced to the grade of member in the Society. Treas. L. C. Plaehn reported that 90 percent of the dues for the chapter had been collected.

In the absence of C. H. Randolph, Mr. Lofte announced that the State Heating and Ventilating Code is now being revised, and that the chapter was going to request that the city of Milwaukee hold up definite action on the code until such state code revision has been completed. A. S. Krenz then stated that the state code committee would welcome any suggestions or recommendations in the code, and that the members should make use of this opportunity. Attendance 119. Attendance ratio 0.30.

STUDENT BRANCHES

• *UNIVERSITY OF TEXAS*: Pres. H. M. Braymer introduced Prof. R. A. Bacon who gave a short talk on the advantages ASHVE has to offer the student member.

President Braymer called the November meeting to order in the Engineering Building. Attendance 21.

• *UNIVERSITY OF TEXAS*: Prof. W. E. Long gave a short explanation of ASHVE to the members. He also explained that all of last year's officers, with the exception of the Secretary, had graduated, thus making it necessary to re-organize the student branch. The following officers were elected: *President*—H. M. Braymer; *Vice President*—J. S. Miller: *Secretary*—A. D. Wilkinson, Jr., *Treasurer*—E. M. Shaw.

The October meeting, which was sponsored and called to order by Professor Long, was held in the Engineering Building. Attendance 14.

• *UNIVERSITY OF TORONTO:* Professor F. G. Ewens acted as Chairman for a short meeting which was called for the purpose of electing officers. Those elected were: *President* — D. S. Harper, *Secretary* — *L. S. Mitchell.* Attendance 15. Attendance ratio 0.60.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 125 applications for membership, including 13 student applications and 8 reinstatements; in addition 9 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by February 27, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Alabama

△DRUM, L. J., JR., Pres., Capital Refrigeration Co., Inc., Montgomery. REFERENCES: M. M. Crout, E. R. Foss, F. D. Graham, F. K. Hardy.

TILLERY, J. M., Mech. Draftsman, Wilmot C. Douglas, Architect, Birmingham. REFERENCES: H. K. Ellett*, G. W. Hogan, Jr., R. W. McKenzie, K. H. Waldon*.

California

BECK, J. C., JR., Engr., Atlas Heating and Ventilating Co., Ltd., San Francisco. REFERENCES: C. E. Bentley, E. C. Fanning, James Gayner, T. J. White.

BLATMAN, SEYMOUR, Jr. Mech. Engr., Allen Engineering, Los Angeles. REFERENCES: Edwin Goldstein*, J. H. Jacoby*, Carl Mohler*, E. F. Slattery*.

BOOTHBY, H. F., Owner, Boothby Sheet Metal, Sacramento. REFERENCES: T. W. Johnston, J. E. Marshall, L. A. O'Meara, R. A. Sarro.

BOWMAN, K. A., Mech. Engr., F. B. Gardner Co., Inc., Los Angeles. REFERENCES: L. B. Davenport, A. J. Hess, H. J. Tilley, C. D. Walz.

BROWN, F. L., Asst. Mgr., Charles M. Bailey Co., San Francisco. REFERENCES: O. E. Andersen*, D. R. Blanchard, K. K. LaPoint, E. C. McKinsey.

DONLEY, W. L., Engr., Minneapolis-Honeywell Regulator Co., Los Angeles. REFERENCES: L. B. Davenport, A. J. Hess, F. M. Neal, Carl Raymond.

HILTON, E. B., Mech. Engr., Kistner, Wright & Wright, Los Angeles. REFERENCES: L. B. Davenport, J. L. McCullough, D. H. Nack*, C. D. Walz.

HOLLANDER, G. M., Assoc. Mech. Engr., Div. of Architecture, State of California, Sacramento. REFERENCES: W. J. Biggar, V. J. Burke, E. C. Evans, F. N. Neal.

JOHNSON, O. C., Sales Mgr., Water Chemists, Inc., Los Angeles. REFERENCES: A. J. Hess, R. H. Savage*, Gordon Schuhmacker*, Ralph Westcott.

NICHOLAS, C. J., Dist. Mgr., Bastian-Morley Co., Inc., Sacramento. REFERENCES: H. D. Brainard, Herbert Lemkau, H. E. Muldoon, L. A. O'Meara.

TAYLOR, R. R., Engr., Fraser & Johnston Co., San Francisco. REFERENCES: Howard Cardiff*, Tom Davenport*, William Johnston*, Mel Lewis*.

TURNER, L. R., Mech. Inspector, U.S. Army Engineers, Marysville. REFERENCES: C. D. Elliot*, E. C. McKinsey, E. E. Phillips, R. E. Sorenson*.

WALKER, R. B., Partner, Park Sheet Metal Co., Sacramento. REFERENCES: D. C. Benbow, J. E. Day, W. C. Denner, T. W. Johnston.

YOUNG, T. J., Engr., American Air Filter Co., Inc., San Francisco. REFERENCES: R. T. Andrews, Edward Hill, Jr., J. E. Murray, R. H. Walpole, Jr.

Connecticut

LEVY, MONROE, Mfrs'. Repr., Red Wing Oil Co., Portland. REFERENCES: Jack

Friedlander*, Mitchel Landau, Samuel Schreiner*, Al Webber*.

Delaware

†ANDERSON, P. R., Engr., Robert P. Schoenijahn, Wilmington. REFERENCES: J. W. McElgin, S. E. Plewes, R. P. Schoenijahn, J. K. Walters.

District of Columbia

SIROTTA, MILTON, Mech. Engr., District Public Works Office, U.S. Naval Gun Factory, Washington. REFERENCES: J. M. Jalenak, Irving Neusihin, Solomon Sirotta*, G. R. Walz.

†WIMMER, C. C., SR., Heating Engr., Harrison Brothers, Washington. REFERENCES: J. M. Beane*, Donald Bellman*, C. W. Fletcher, J. C. Flood*.

Florida

DUNLOP, HENRY, Sr. Design Draftsman, Seaboard Machinery Corp., Panama City. REFERENCES: V. E. Cucci, C. M. Leavitt*, A. Mair*, C. R. Schaeffner*.

△GRAZIANO, S. F., Secy., Typhoon Prop-R-Temp Corp. of Florida, Tampa. REFERENCES: R. J. Clark, J. F. Dailey, G. C. Hall, Leo Toribio*.

Illinois

†BENSON, B. C., Sales Mgr., Hospital Controls Div., Minneapolis-Honeywell Regulator Co., Chicago. REFERENCES: H. E. Anderson, N. E. Bueter, O. W. Dauber, R. E. Moore.

△CLO, H. E., Engr., Air Filter & Equipment Co., Chicago. REFERENCES: M. W. Bishop, H. G. Gragg, J. W. May, J. H. Milliken.

MARSHALL, W. J., Technical Dir., Insulation Board Institute, Chicago. REFERENCES: S. T. Carpenter*, W. L. McCabe*, F. B. Rowley, F. W. Yeager*.

MEYER, W. W., Pres., General Blower Co., Morton Grove. REFERENCES: J. E. Clark, H. T. Kucera, W. T. Pennington, L. E. Schulein.

PERRINE, E. L., Sr. Physicist, Zonolite Company Research Laboratory, Evanston. REFERENCES: L. A. Barron, D. L. Collins*, H. A. Leedy*, R. F. Rea.

△POTVIN, L. J., Pres., Fenner & Potvin, Inc., Chicago. REFERENCES: F. H. Gaylord, S. R. Lewis, M. F. May, N. D. Skinner.

Indiana

EGGELHOF, R. H., Mfrs. Repr., Indianapolis. REFERENCES: A. G. Dixon, W. H. Dwyer, J. H. Ruddell*, F. A. Stickle.

Iowa

WALTERS, P. A., Engr., B. E. Landes, Cons. Engr., Des Moines. REFERENCES: L. E. Gnade, T. R. Johnson, B. E. Landes, R. H. Schnell.

Kansas

BAKER, L. D., JR., Mgr., Heaven Engineering Co., Wichita. REFERENCES: B. L. Blackburn, O. P. Bullock, E. G. Fahnestock, L. P. Heaven.

HEWITT, J. B., Engr., Todd Roberts Insulation Co., Wichita. REFERENCES: B. L. Blackburn, J. L. Crawford*, T. C. Pitts*, S. F. Whitley.

STRAHM, O. B., Vice Pres., Industrial Engineering Co., Inc., Wichita. REFERENCES: R. F. Bauer, Peter Ketelsen*, J. W. Kice, M. M. Ross*.

WHITNEY, K. P., Engr., Heaven Engineering Co., Wichita. REFERENCES: B. L. Blackburn, O. P. Bullock, E. G. Fahnestock, L. P. Heaven.

Louisiana

CAMEON, E. D., JR., Dist. Sales Engr., Industries Sales Corp., New Orleans. REFERENCES: C. V. Bankston, L. V. Busenlener, R. B. Guest, E. O. Thoman.

CAZENAVETTE, L. L., Engr., Cary B. Gamble & Assocs., New Orleans. REFERENCES: Ralph Elizardi, C. B. Gamble, W. B. Martin, Jr., T. A. Stokes.

HINDELANG, W. P., JR., Nos Engineering, New Orleans. REFERENCES: F. L. Alcus*, C. E. Ammen*, J. D. Maddox, I. M. Richardson.

†KNIGHT, J. T., JR., Mgr., Air Conditioning & Refrigeration Div., Equitable Life Insurance Co., New Orleans. REFERENCES: Walter Cooke, R. K. Goode, W. P. Oster, J. V. Reuter, Jr.

△MARTIN, W. B., JR., Engr., Cary B. Gamble & Assocs., New Orleans. REFERENCES: P. E. Coe, Jr., Ralph Elizardi, C. B. Gamble, T. A. Stokes.

PAILET, GUSTAVE, Engr., Gulf Engineering Co., Inc., New Orleans. REFERENCES: W. L. Clay, T. J. Jenny, Theodore Offner, H. N. Stall.

WILSON, G. E., JR., Engr., Airco Refrigeration Service, Inc., New Orleans. REFERENCES: C. V. Bankston, W. J. Johnson, Robert Post, E. O. Thoman.

Maryland

EHRLICH, SAMUEL, Engr., Office of Hal A. Miller, Baltimore. REFERENCES: S. A. Bogen*, A. Ehrlich*, C. A. Fuller, H. A. Miller*.

THOMPSON, W. H., Consultant, William H. Thompson, Cons. Engr., Baltimore. REFERENCES: R. L. Hughes, Jr., E. R. Kent, E. H. Taze, J. K. Wolford.

Massachusetts

†FIELD, ERLUND, Vice Pres., Whitley Company, Inc., Boston. REFERENCES: W. J. Ahearn, John Bonner, L. A. Brissette, C. T. Flint.

LUCHNER, L. F., Engr., Richard C. Thompson, Boston. REFERENCES: A. I. Brayman, J. W. Brinton, C. T. Flint, C. W. Kimball.

Michigan

BOALES, W. G., JR., Jr. Sales Engr., William G. Boales & Assocs., Detroit. REFERENCES: W. G. Boales, J. W. James, L. L. McConachie, K. E. Robinson.

NESBITT, K. A., Engr., Westerlin and Campbell Co., Detroit. REFERENCES: W. E. Barnum, Eugene Borak, D. S. Falk, E. F. Glanz.

Minnesota

KISPERT, M. B., Mech. Engr., Ellerbe and Co., St. Paul. REFERENCES: G. M. Kendrick, J. A. Rudberg, R. J. Ruth, William Sturm.

MATHISON, D. W., Asst. Chief Engr., The Waterman Waterbury Co., Minneapolis. REFERENCES: O. W. Griefnow, F. J. Maney, D. E. Sedgwick, W. A. Swenberg.

NELSON, R. O., Sales Mgr., Tjernlund Mfg. Co., St. Paul. REFERENCES: William Gosewitz*, Leland Lincoln, Roger Ostrom*, J. F. Siegel.

Missouri

BARNETT, CLAYTON, Mgr., Heating Div., Barnett Fuel Co., Kansas City. REFERENCES: W. H. Brackmann, W. J. O. Wagner, E. C. Webb, L. E. Zumbehl.

FILLO, J. S., Br. Mgr., General Controls Co., St. Louis. REFERENCES: C. J. Baker, E. C. Kuntz, B. L. Lerch, L. M. Schwind.

HOCKER, E. F., Draftsman, Reeves Wiedeman Co., Kansas City. REFERENCES: F. F. Dodds, Henry Nottberg, Jr., E. E. Ralston, R. H. Stamm.

MALONE, C. E., Pres., C. E. Malone Co., Inc., St. Louis. REFERENCES: Hamilton Hazel*, C. R. Kranz*, W. B. Watterson, L. E. Zumbehl.

MCWILLIAMS, M. H., Designer, The Marley Co., Kansas City. REFERENCES: H. E. Degler, W. O. Kretzmeier, O. G. Linimon, L. T. Mart.

OLDERSHAW, R. E., Engr., Wholesale Equipment Corp., Kansas City. REFERENCES: F. J. Dean, Jr., E. S. Keller, N. G. Humphreys, G. H. Stoffer.

†SCHUKAI, W. C., Pres., Eichler Co., St. Louis. REFERENCES: E. T. Clucas, L. L. Hamig, G. E. Horch, W. J. Oonk.

THOMPSON, J. W., Engr., The J. W. Thompson Co., St. Louis. REFERENCES: M. L. Aitken, E. T. Clucas, H. C. Sharp, E. E. Trickler.

THOMPSON, JESS W., Mfrs. Agent, The J. W. Thompson Co., St. Louis. REFERENCES: M. L. Aitken, E. T. Clucas, H. C. Sharp, E. E. Trickler.

WRIGHT, J. A., Product Engr., White-Rodgers Electric Co., St. Louis. REFERENCES: M. C. Kaber, R. O. Reeves, V. J. Suche, J. C. Watkins.

New Jersey

CHIPMAN, J. M., Heating and Ventilating Consultant, Maplewood. REFERENCES:

William Caddle, Jr., B. P. Hyde, W. C. Kruse, Jr., W. F. Raymer, Jr.

CURRIE, ADAM, Chief Research Engr., L. J. Wing Manufacturing Co., Linden. REFERENCES: H. E. Parker, C. H. Smith, T. A. Walters, H. S. Wheller.

FOX, HERBERT, Sr. Partner, Fox & Taylor, Cons. Engrs., Newark. REFERENCES: Russell Donnelly, W. M. Heebner, G. C. Norman, D. F. Parker.

GAREY, L. L., Sr. Engr., Public Service Electric and Gas Co., Newark. REFERENCES: W. C. Kruse, Jr., J. P. Leinroth, H. P. Morehouse, G. C. Norman.

HAMILTON, D. H., Sales Engr., Superior Steam Generators of New Jersey, East Orange. REFERENCES: M. C. Christesen, S. H. Nitzberg, P. H. Oppenheimer, Milton Simkin.

HERMES, A. J., Design Engr., Merck & Co., Rahway. REFERENCES: V. F. Eckstein*, P. B. Gordon, E. S. Mehnert*, R. F. Schuerer*.

KING, H. A., Sales Engr., Associated Thermal Products Inc., Jersey City. REFERENCES: L. D. Carr, A. L. Croohe, F. R. Ellenberger, F. H. Faust.

KURMES, ALEX, Owner, Alex Kurmes Co., Montclair. REFERENCES: J. P. Glasby*, Howard Niles*, Julian Tebo*, R. D. Terhune.

MACNAIR, H. A. W., Sales Engr., Minneapolis-Honeywell Regulator Co., East Orange. REFERENCES: A. H. Bermel, William Caddle, Jr., Ernest Graber, P. H. Oppenheimer.

MILLER, I. B., Designer, Pacific Engineering Equipment Co., East Orange. REFERENCES: M. C. Christesen, E. J. Grady, J. W. Turner*, C. W. Zimmer.

MILLER, KENNETH, Owner, Pacific Engineering Equipment Co., East Orange. REFERENCES: William Caddle, Jr., M. C. Christesen, E. J. Grady, H. B. Steggall.

MORRISON, R. W., Engr., The Conditioning Co., Newark. REFERENCES: A. H. Bermel, E. C. Lang, George Norman, Oscar Vogelbach*.

MURRAY, G. F., Engr.-Estimator, Fred Wendel, Oradell. REFERENCES: W. M. Heebner, M. Y. Huyett, J. F. O'Brien, F. E. Wendel.

OLEN, STEPHEN, Sales Engr., Minneapolis-Honeywell Regulator Co., East Orange. REFERENCES: William Caddle, Jr., Ernst Graber, P. H. Oppenheimer, Robert Reis.

PAINTER, S. H., JR., Product Specialist, General Electric Co., Bloomfield. REFERENCES: F. H. Faust, L. G. Huggins, G. K. Iwashita, G. K. Marshall.

PITTS, B. J., Repr., Conditioning Co., Inc., Newark. REFERENCES: S. W. Brown, Albert Giannini, E. C. Lang, G. C. Norman.

New York

CARETSKY, MARVIN, Designer, Voorhees, Walker, Foley & Smith, New York. REFERENCES: Stanley Dicker, R. A. Nyman, Philip Schatkun, Irving Silverman.

CLAY, FRANK J., Supervisor of Process Piping, Heating, Ventilation, Linde Air Products Co., Tonawanda. REFERENCES: H. D. Edwards, L. G. Hubbell*, H. W. Kirchner*, E. H. Praybys*.

CURSONS, S. L., Mfrs. Repr., Warner E. Spencer Assocs., Buffalo. REFERENCES: A. Higinbothan*, L. N. Hopkins, Jr., F. P. Langley*, F. J. Weber.

DWYER, W. R., Construction Engr., The J. M. Fink Co., Inc., New York. REFERENCES: A. C. Buffalano, J. R. Duncan, J. M. Fink, B. B. Howes.

GOLDREYER, A. H., Asst. Engr., Afgo Engineering Corp., Brooklyn. REFERENCES: Henry Kindler*, Murray Liehlich, G. E. Olsen, Nathan Wolpert*.

HARBISON, E. J., General Construction Superintendent, Cohn & Kramer, Plumbing & Heating Contractors, Albany. REFERENCES: H. H. Bond, M. M. Cohn, Frank Keis*, J. M. Ryder*.

JOHNSON, J. D., Supervisor, Air Cond. & Refrig., Rochester Gas & Electric Corp., Rochester. REFERENCES: R. E. Cherne, S. H. Perkins, N. E. Sheldon, W. H. Stell, Jr.

LEE, E. K., Mfrs. Repr., Minneapolis-Honeywell Regulator Co., Syracuse. REFERENCES: I. W. Gilbert, F. E. Krell, J. G. Manion, H. J. Morton.

LOVELACE, G. E., Sales Engr., Minneapolis-Honeywell Regulator Co., Syracuse. REFERENCES: C. R. Acheson, R. A. Baker, O. H. Hellekson, J. G. Manion.

MANNING, J. J., Engr., Aerofin Corp., Syracuse. REFERENCES: J. H. Carpenter, L. A. Childs, L. H. Fritzberg, Milner Noble.

PARSONS, F. E., Staff Engr., *National Mineral Wool Association*, New York. REFERENCES: H. E. Lewis, C. E. Lund, Cyril Tasker, G. B. Wilkes.

ROBERTS, D. K., Air Conditioning Engr., Thermodyne Corp., New York. REFERENCES: Vincent Arnold*, Bernard Gerb*, H. J. Rosenberger*, Robert Rosenblatt.

ROHDE, M. A., JR., Gas Heating Engr., Rochester Gas & Electric Corp., Rochester. REFERENCES: R. E. Cherne, S. H. Perkins, W. H. Stell, Jr., E. F. Wehlage.

SPENCER, J. E., Sales Mgr., Warner E. Spencer Assocs., Buffalo. REFERENCES: L. N. Hopkins, Jr., F. P. Langley*, J. M. Quackenbush, F. J. Weber.

UDOLF, G. A., Industrial Engr., E. A. Laboratories, Inc., Brooklyn. REFERENCES: R. A. Alpert, S. T. Kollisch*, L. Ottaviano*, S. Wagner*.

North Carolina

CAVENESS, H. L., Pres., Loman Supply & Equipment Co., Inc., Greensboro. REFERENCES: C. Z. Adams, W. D. Graham, Jr., P. L. Guest, Jr., J. M. Pleasants.

Ohio

ADAMS, H. E., Mgr., Heating Dept., Crane Co., Cincinnati. REFERENCES: F. B. DeBra, J. A. Diehl, F. J. Ward, O. C. Zacharias.

BENNETT, W. J., JR., Pres., J. A. Myers Co., Columbus. REFERENCES: A. D. Bogen, J. A. Guy, A. R. Sweeney, A. H. Wolfe.

BERKILD, P. G., Sales Repr., Grinnell Co., Cleveland. REFERENCES: Harold Bergman, H. J. Kaschyk, Sherwood Nassau, R. E. Sherman.

BUBSER, J. J., Sales Engr., G. B. Houliston Co., Cincinnati. REFERENCES: G. B. Houliston, W. H. Junker, D. E. Morgan, C. D. Weaver.

CREPPS, R. B., Director, Testing Div., Owens-Corning Fiberglas Corp., Newark. REFERENCES: C. E. Lund, E. R. Queer, T. D. Stafford, Cyril Tasker.

FRANKEL, N. A., JR., Sales Engr., Helburn Engineering, Cincinnati. REFERENCES: J. C. Groves*, I. B. Helburn, H. J. Noles, D. D. Wile.

GILMORE, J. L., Asst. Engr., Cincinnati Air Conditioning Co., Cincinnati. REFERENCES: R. A. Albrecht, Jr., H. W. Moore, T. D. Reiley, F. W. Wilson.

GLEASON, A. C., Mgr., Heating Dept., Crane Co., Cleveland. REFERENCES: Harold Bergman, R. L. Byers, W. F. D. Neiheiser, J. E. Wilhelm.

KROEGER, F. J., Engr., The William Powell Valve Co., Cincinnati. REFERENCES: J. J. Bechtol, R. J. Clark, B. T. Hauer, H. C. Smith.

Oklahoma

SHAW, J. D., Industrial Sales Engr., Public Service Co., Tulsa. REFERENCES: J. H. Heller*, H. W. Meinholtz, W. C. Roads, R. F. Shoemaker.

Oregon

SCHENCK, J. P., Designer, J. Donald Kroeker & Assocs., Portland. REFERENCES: J. D. Kroeker, O. W. Matthews, III, W. D. Maxwell, C. C. Schenck*.

Texas

†ALBRIGHT, C. B., Partner, Gaynor, Donley and Albright, Dallas. REFERENCES: Howard Angle*, A. M. Gaynor*, W. A. Sherbrooke, C. P. Wallace.

ANDREWS, S. D., Br. Mgr., General Controls Co., Dallas. REFERENCES: W. A. Catlett, W. H. Kuhn, H. H. Pitman, J. D. Poythress.

△EVANS, RONALD, Mech. Engr., The Austin Co., Houston. REFERENCES: W. B. Buck, J. C. Davidson, Robert McGinty*, H. C. Price*.

HAFKEMEYER, G. F., JR., Sales Engr., United Gas Corp., Houston. REFERENCES: J. P. Holle, W. E. Long, C. A. McKinney, R. J. Salinger.

JACKSON, W. A., Sales Engr., Rodgers & Co., Houston. REFERENCES: D. S. Freese, J. N. Powell, E. E. Ransom, Jr., J. G. Thompson, Jr.

†LIPPERT, W. M., Sales Engr., United Gas Corp., Houston. REFERENCES: W. L. Barnes, W. E. Long, C. A. McKinney, R. J. Salinger.

LYONS, ALVA, JR., Chief Engr., Raymond L. Jenkins, Houston. REFERENCES: D. S. Cooper, D. S. Freese, R. L. Jenkins, R. J. Salinger.

MARSH, R. E., Sales Engr., Minneapolis-Honeywell Regulator Co., Houston. REFERENCES: D. S. Cooper, J. A. Poole, O. G. Rivoire, Norman Way.

SAFFORD, H. G., JR., Supervisor, Commercial Sales Dept., Houston Lighting & Power Co., Houston. REFERENCES: H. U. Bible, D. S. Cooper, R. L. Jenkins, R. J. Salinger.

△WALKER, R. A., Sales Engr., Matthews Engineering Co., Dallas. REFERENCES: J. A. Bishop, Herman Blum, Jr., L. S. Gilbert, D. C. Pfeiffer.

Utah

LESLIE, W. C., Mfrs. Repr., Crane Co., Salt Lake City. REFERENCES: P. O. Boyer, A. R. Curtis, W. L. Stuewe, D. R. Wilde.

Washington

BECK, F. G., Asst. Cost Estimator, Bouillon and Griffith, Seattle. REFERENCES: Lincoln Bouillon, L. F. Christofferson, H. T. Griffith, G. H. Toner.

△KIRKWOOD, R. R., Mech. Engr., John Graham & Co., Seattle. REFERENCES: M. J. Hauan, Arthur Herzog, J. B. Notkin, C. A. Pangborn.

MARTIN, G. H., Asst., C. A. Pangborn, Cons. Engr., Seattle. REFERENCES: M. J. Hauan, H. M. Hendrickson, R. R. Kirkwood, C. A. Pangborn.

West Virginia

RODGERS, J. P., Sales Engr., The Trane Co., Clarksburg. REFERENCES: E. J. Kelly, R. G. Lubinsky, R. C. Tonry, R. M. Toucey.

Wisconsin

INNES, J. C., Sales Trainee, Mueller Furnace Co., Milwaukee. REFERENCES: V. P. Hansen, N. E. Hill, F. J. Nunlist, Jr., L. C. Plaehn.

Dominion of Canada

DURRELL, J. L., Supt., Williams Brothers, Smith Falls. REFERENCES: Irving Goodman, J. L. Neilans, E. J. Schoenherr, H. M. Treleaven.

MCCONNELL, J. K., Pres., Kemp Agencies Ltd., Vancouver. REFERENCES: D. M. Drake, R. W. Hole, D. W. Thomson, S. W. Welsh.

△NORTON, E. H., Asst. Mgr., Leek & Co., Ltd., Vancouver. REFERENCES: S. C. Gale, R. W. Hole, C. W. Leek, M. E. Minaker.

PHILLIPS, E. C., Asst. to General Mgr., Trane Company of Canada, Ltd., Toronto. REFERENCES: J. P. Fitzsimons, J. W. O'Neil, A. J. Strain, H. M. Treleaven.

England

HANCOCK, E. S., Jr. Partner, Donald, Smith, Seymour & Rooley, Stretford. REFERENCES: A. L. Longworth, G. A. Rooley*, D. V. H. Smith, H. Swain*.

Hawaii

HAMILTON, R. E., Mgr., Air Conditioning & Air Handling Apparatus, The Hawaiian Electric Supply Co., Honolulu. REFERENCES: F. W. Jordan, F. R. Montgomery*, James Simms*, Eugene Urbain*.

Hong Kong

CHAUVIN, H. F. G., Chief Engr., International Entertainment Enterprises, Ltd., Hong Kong. REFERENCES: W. L. E. Miller*, P. V. Reveley, W. S. B. Wong, C. L. Yin.

Iceland

PALSSON, PETUR, Research Engr., The University Research Institute, Reykjavik. REFERENCES: Thorir Baldvinsson*, W. H. Gauvin*, Bjorn Johannesson*, Gisli Thorkelsson*.

Switzerland

BROWN, HERBERT, Branch Mgr., Sulzer Brothers, Ltd., Zurich. REFERENCES: Jean Bauer, Werner Niederer, Walter Oertli, Walter Sennhauser.

Students

PURDUE UNIVERSITY, Lafayette, Ind. CERTIFIED BY: F. B. MORSE

BROWN, D. W.

THE UNIVERSITY OF TEXAS, Austin, Tex. CERTIFIED BY: W. E. Long.

BOYCE, T. H., JR.
BRAYMER, H. M.
BROWN, T. D.
BURSON, J. E.
DAVIS, J. P.
KATZ, E. S.
MAYO, WILLARD
MILLER, J. S.
SHANKEN, M. L.
SHAW, E. M., JR.
WILKINSON, A. D., JR.
WILLRODT, A. J.

OBITUARIES

GEORGE O. JACKSON
Indianapolis, Ind.

Word has been received by the Society of the death of George O. Jackson, Indianapolis, on November 17. Mr. Jackson, who originally joined the Society in 1928, had been an Associate Member.

Born on July 21, 1884 in Gallion, Ohio, he received his formal education in Indianapolis. Following his schooling, Mr. Jackson received his technical and professional training in heating and ventilating with the Indiana Supply Co., 1908-1914, as sales engineer and designer. In 1914-1916 he became connected with the Van Camp Hardware and Iron Co. After severing this connection, he went with the Jackson Supply Co., and remained with them till 1923. In 1923 Mr. Jackson was associated with the Jackson Engineering Company, and at the time of his death, he was president of the firm; his chief duties being those of sales engineer and administrator. From the beginning of his professional career, Mr. Jackson had been responsible for the installation of heating plants in many firms throughout Indiana.

Mr. Jackson was also a member of *Scientech Club* and the *Kiwanis* of Indianapolis. The Council and Society deeply regret the loss of Mr. Jackson.

EUGENE D. MILENER
New York, N. Y.

E. D. Milener, member of the Society since 1936, died suddenly in Raleigh, N.C., on November 20, while attending the annual meeting of the *Mid-Southeastern Gas Association.*

Born in Norfolk, Va., on April 14, 1892, Mr. Milener attended *Baltimore Polytechnic Institute*, and graduated from the University of Maryland with a B.S. He held various positions

with the Consolidated Gas Electric Light and Power Company of Baltimore, including supervisor of industrial and house heating sales. In 1915-16, he devised the *degree-day* method of calculating gas requirements for heating different types of buildings under varying temperature conditions. This method now is generally used throughout the gas industry and by the heating, ventilating and air conditioning industries.

Mr. Milener joined the *American Gas Association* in 1928 as industrial gas research engineer and was chairman of the Central House Heating Approval Requirements Committee when the Approval Requirements Code was being compiled. In December, 1935, Mr. Milener was appointed secretary of the Industrial Gas Section of *AGA*, continuing in that capacity when the Industrial and Commercial Sections of the Association were combined.

In 1946, he was appointed coordinator of general research of *AGA* under the Association's integrated Promotion, Advertising and Research Plan, and in 1948 he became coordinator of utilization research. In 1951, Mr. Milener was appointed secretary of the Manufactured Gas and the Natural Gas Departments of *AGA*. When separate departments of the Association were eliminated under the revised Constitution and By-Laws early in November, 1952, Mr. Milener became coordinator of special activities, in which capacity he was serving at the time of his death.

Mr. Milener is survived by his wife, Mrs. Eleanor Hope Milener and by his son Eugene D. Milener, III, now in military service, to whom the Officers and Council extend their sincere sympathy. Interment was in Baltimore, Md.

CHARLES A. MILLER
New York, N. Y.

Life Member, Charles A. Miller, who had been ill at the Waldean Manor Nursing Home in White Plains, New York for the past six months, died on December 4. Mass was held at the St. Philip of Neri Church in The Bronx and burial was at the family plot in Woodlawn Cemetery.

Born on July 20, 1875, in New York City, Mr. Miller attended public school there. His technical training was received at Cooper Union. He served his apprenticeship with Gillis and Goeghegan from 1892 to 1896 in heating and ventilating. He also acquired his drafting experience there. In 1897 Mr. Miller joined The H. B. Smith Company of New York City. He remained with them for a period of over fifty years, at which time he retired. He was employed as a salesman of boilers and radiators, and directed the installation of such apparatus.

Charles A. Miller

Mr. Miller is survived by a sister, Mrs. Charles Schneider, to whom the Officers and Council of the Society express their deep sympathy.

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Members of ASHVE
Moved or Moving?

Each month mail is returned BECAUSE you overlooked advising us of the change in your address.

The return mail is a loss to you, and an added expense to the Society.

In your own interest, will you please advise us at once of any change in your business or home address, indicating which is your mailing address.

ASHVE Headquarters
62 Worth St.
New York 13, N. Y.

JOHN C. PASTOR
Jacksonville, Fla.

The Society was greatly shocked by the death of John C. Pastor, a familiar and highly respected figure in the profession. Mr. Pastor's death, after a short heart illness, came unexpectedly as he had been making a remarkable recovery.

Born March 17, 1888 in Harrisburg, Pa., Mr. Pastor enrolled in a scientific course at the Harrisburg High School. Upon graduation, he attended the Bucknell University from 1908-09. The same year he became associated with the Bridge Department of the Pennsylvania Steel Co., Steelton. From 1910 to 1914 he went into the contracting business of streets, roads, bridges and general concrete construction. For the next two years Mr. Pastor was foreman and resident engineer for the Pennsylvania Central Light and Power Co. in charge of construction and remodeling of power plants which included the buildings and equipment. From 1916-1920, he was quarterman in the Emergency Fleet Corp. at Hog Island, Pa., in charge of outfitting the ships for mechanical equipment.

From 1920 to 1924 Mr. Pastor resumed his formal studies at the University of Michigan, college of engineering, as a special student. The year he finished his studies, he became associated with Detroit Edison Co. in the Trenton Channel Plant as foreman. The following year he was made superintendent of the Michigan State Highway Department, where he was in charge of bridge construction for the southeast portion of Michigan. From 1927 to 1931 he was connected with the American Radiator Co. in designing heating systems and as sales engineer. From 1931 to the time of his death, Mr. Pastor was self employed. A large portion of his business was making layouts for heating, ventilating and air conditioning; plumbing and central heating and power plants. At the same time Mr. Pastor acted as a manufacturers' representative.

Mr. Pastor is survived by his widow to whom the Council and the Society express their deep sympathy.

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Headquarters: 62 Worth St., New York 13, N. Y.
Research Laboratory: 7218 Euclid Ave., Cleveland 3, Ohio

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*Member of Committee on Research.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(52 Chapters—1 Special Branch—9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, Herman Cumnock, 401 W. Capitol Ave. SECRETARY, W. J. Franklin, 1516 S. Pierce St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. G. Croley, 400 Batavia St., East Point, Ga. SECRETARY, T. A. Barrow, 157 Simpson St., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. R. Kent, 2322 N. Charles St. (18). SECRETARY, A. M. Kroft, 3935 Stokes Dr. (29).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, M. F. Minaker, 1128 Burrard St. SECRETARY, D. W. Thomson, 445 Richards St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. E. Krell, 116 Fernwood Ave. (5). SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, A. D. Bogen, 330-34 E. Livingston Ave. (15). SECRETARY, J. A. Guy, 219 King Ave. (1).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, H. E. Russell, 4th & Main Sts., Box 960. SECRETARY, F. W. Wilson, 222-24 E. 14th St.

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, T. L. Arnold, 26 Francis Ave., Hartford (6). SECRETARY, C. L. L'Hommedieu, 76 Blatchley Ave.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, Walter Cooke, 816 Howard Ave. (13). SECRETARY, T. J. Jenny, 1000 S. Peters St. (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, Harry Horowitz, 889 Warren St. (3). SECRETARY, R. J. Tougher, Menands Rd., Loudonville, N. Y.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. White, 625 Market St. (5). SECRETARY, Eric Roberts, 417 Market St. (5).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, M. W. Bishop, Rm. 1504, 228 N. LaSalle St. (1). SECRETARY, G. V. Zintel, 1217 W. Washington Blvd. (7).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, J. T. Hardin, 720 Noble St. (2). SECRETARY, P. O. Patterson, 2701 Roosevelt Ave., (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, T. P. Nau, S. 1419 Walnut (9). SECRETARY, H. A. Bickel, E. 7 Riverside Ave.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schnell, 1617 33rd St. (11). SECRETARY, Bowen Campbell, 1435 Casady Dr. (5).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, Rm. 606, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Beraman, Box 95, Riverdale Sta. (5). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, C. A. Strand, 9117 Hamilton Ave. (2). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, William Sturm, 2160 Highland Pkwy., St. Paul (5). SECRETARY, J. G. Hamm, 850 Cromwell Ave., St. Paul (4).

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, W. G. Hole, 7035 Grand Ave. (14). SECRETARY, D. L. Lindsay, 1411 Crescent St. (25).

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 608 City Hall (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, P. B. Gordon, 222 E. 41st St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 3114 Peebles Drive.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, J. H. Ross, 1251 Yonge St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, K. H. Hanson, 104 S.E. Seventh (14). SECRETARY, W. R. Norte, 2225 N.E. Broadway (12).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, P.O. Box 7077, Riverton Hgts. Br. (88).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, M. E. Barnard, 12 S. 12th St. (7). SECRETARY, C. J. Lubking, 5060 Wayne Ave.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, N. H. Brickham, 2715 S. Humboldt St. (10). SECRETARY, A. S. Widdowfield, 1925 Blake St. (2).

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. PRESIDENT, L. A. O'Meara, 1400 Tenth St. SECRETARY, J. E. Marshall, 441 Pico Way (19).

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, C. H. Burnap, 235 Keruish Pl., Webster Groves (19). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, W. S. Evans, 614 Johnson Bldg. SECRETARY, J. S. Malahy, Jr., 1839 Line Ave.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, 245 Esperson Bldg. (2).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, J. S. Earhart, 2734 Fleur Dr., San Marino (9). SECRETARY, C. D. Walz, 3600 San Pasqual St., Pasadena (10).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. M. Warren, Jr., P.O. Box 1755, Charlotte. SECRETARY, J. A. Rice, P.O. Box 1755, Charlotte.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH: 1944.** Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, D. R. Wilde, 2634 S. 19th E. (1). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, D. F. Phillips, P. O. Box 674, Newport News. SECRETARY, H. E. Marquart, 111 W. Main St. (10).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. R. Walz, 5214 25th Pl. N., Arlington (7) Va. SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N.W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, I. M. Quackenbush, 505 Franklin St. (2). SECRETARY, Q. P. Thompson, 260 Richmond Ave. (22).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lolte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, I. J. Rossiter, 231 W. Wisconsin (3).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr. 172 ,Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, Stuart Cohen, 513½ Knoblock. SECRETARY, H. G. Rice, 5 Chickasha, Box 417 Vets Village.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, D. W. Blair, 223 W. 15th St. SECRETARY, C. D. Cannon, 404 N. 26th St.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. I. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.

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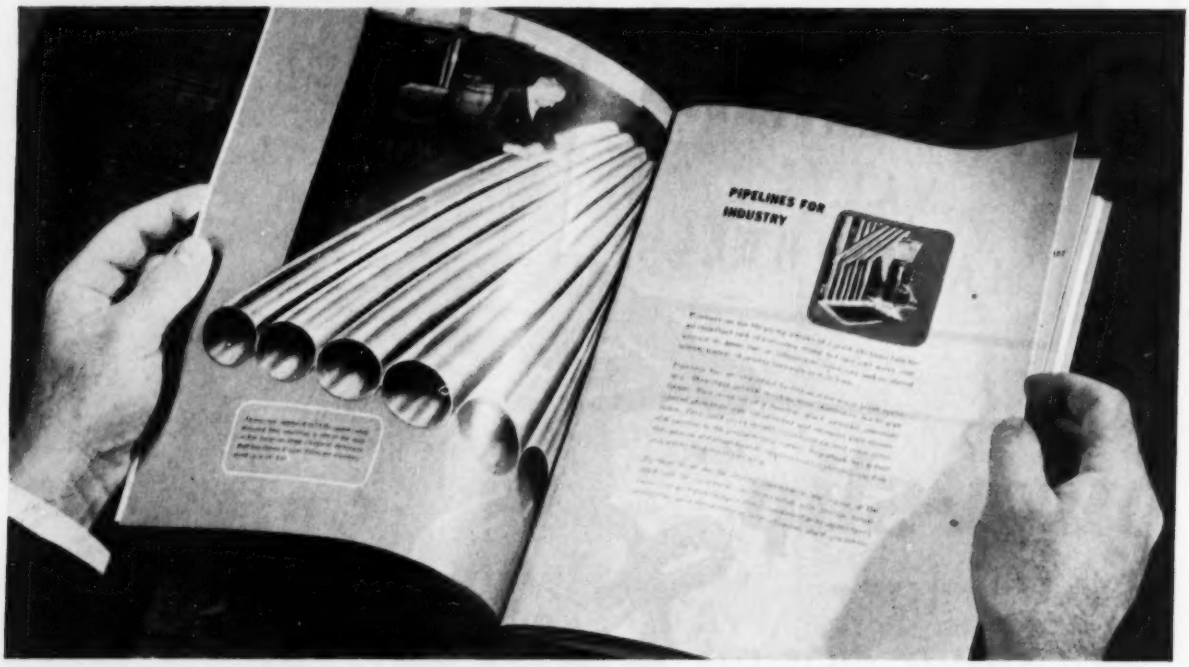

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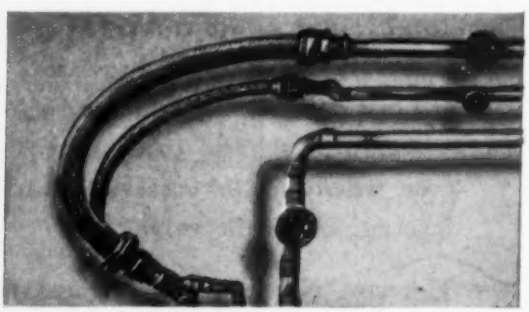

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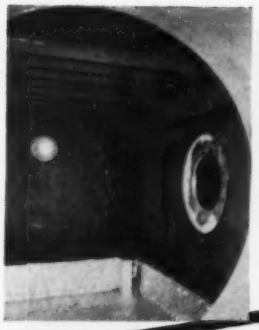

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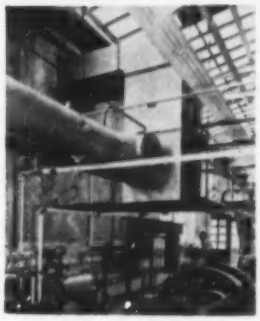

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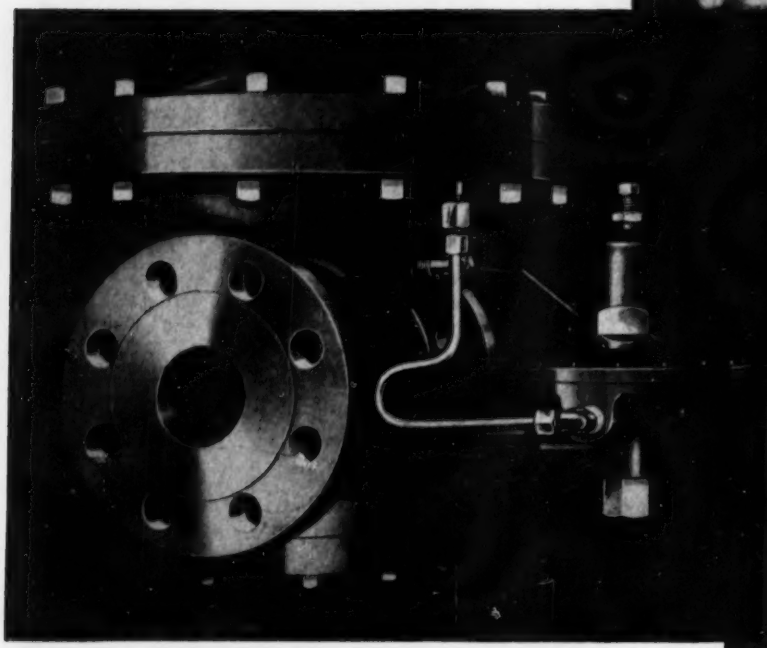

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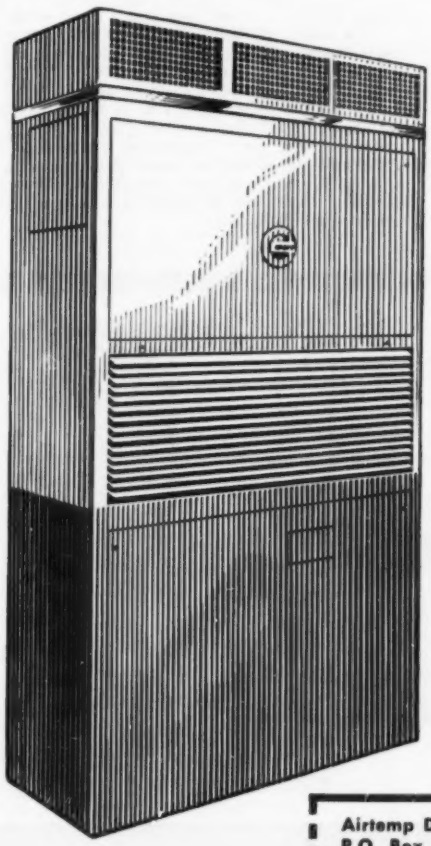

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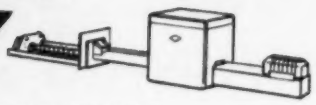

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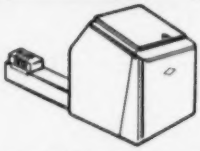

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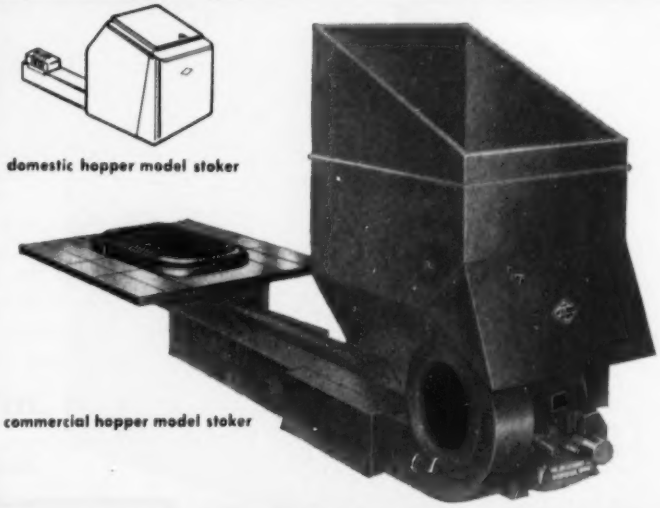

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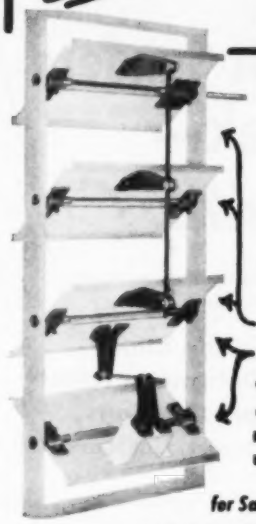

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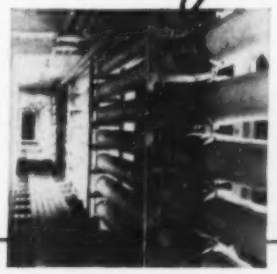

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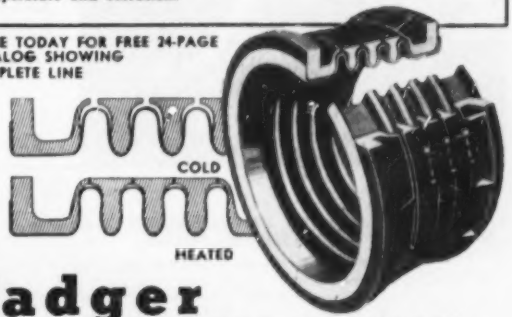

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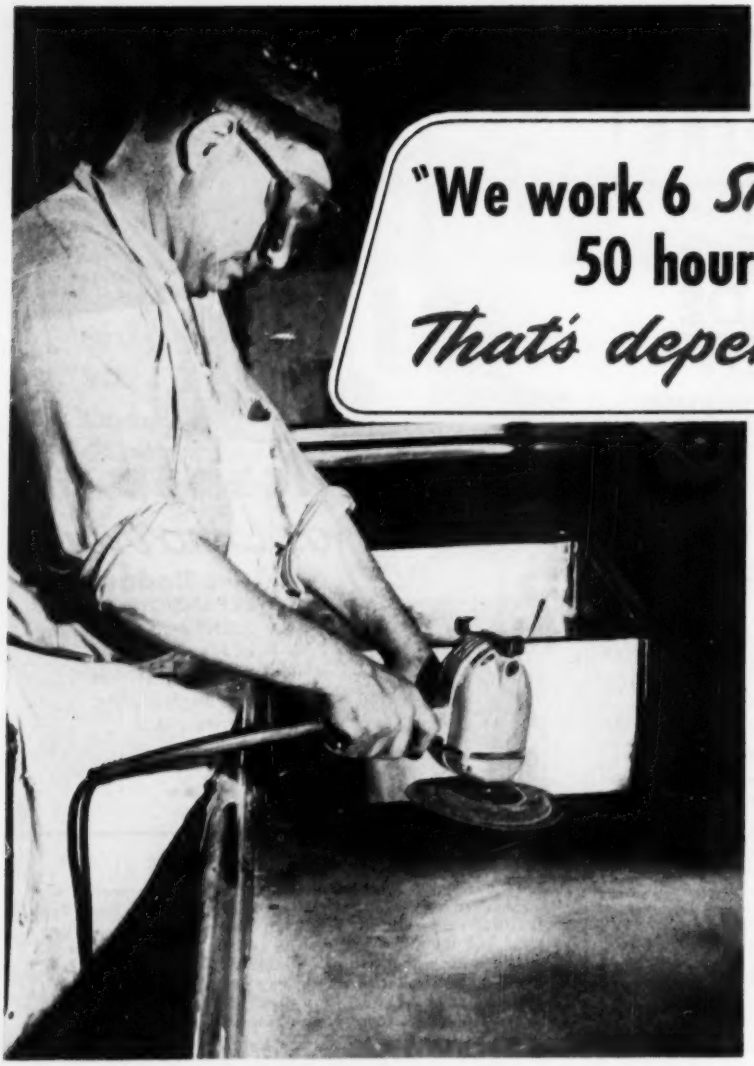

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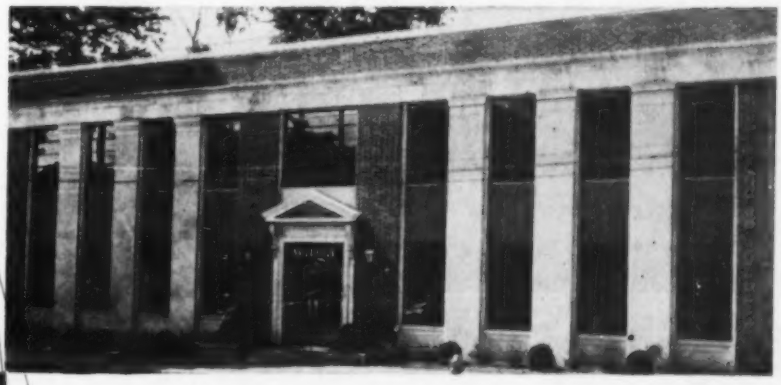

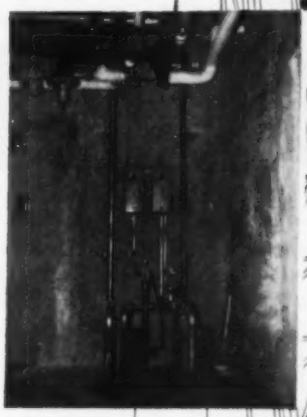

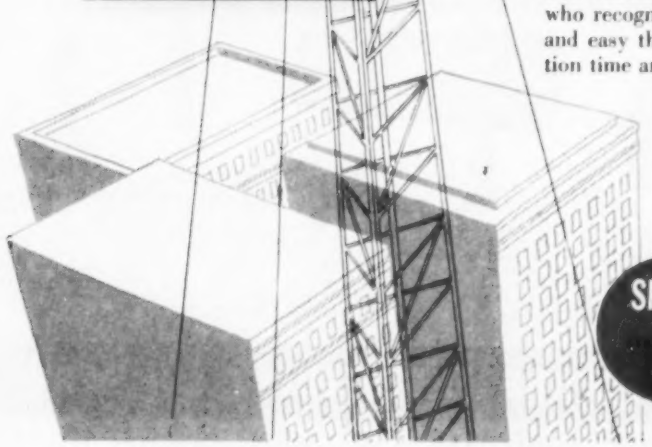

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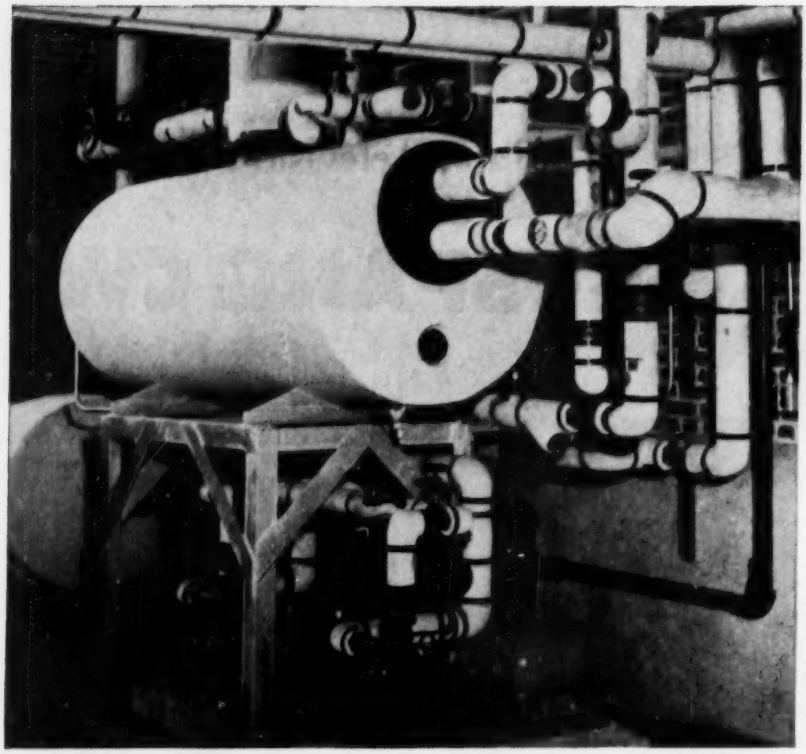

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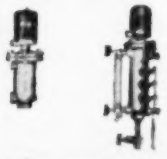
SCHAUB'S YOUR BUY!

Look at Schaub's three outstanding *exclusive features*. Check them point for point with your own experience. Then you'll realize how much more these *plus values* really mean...and why a Schaub System can actually give you more—in low-cost maintenance, improved operating economy . . . and enduring dependability for many years to come. In short, you can't afford to buy a boiler return system until you know the Schaub story ...then, you won't be satisfied with less.

Only* SCHAUB *Has This Exclusive Combination of Features . . .

No more periodic pump maintenance! Schaub Master-Bilt Pumps have new Fleximatic Mechanical seals and permanently lubricated ball bearings. No more water puddles. No more scored shafts. No pump packing or greasing to do—ever!

10-year receiver corrosion guarantee. Schaub engineers worked with leading chemical researchers to develop the Chromosoid lining. You're safe from costly premature replacements. No more rust-clogged systems.



Schaub Systems use only proven super-SAFE Magnetrol pump control and low-water cut off. No bellows to stiffen, no packing to bind, no tricky electrode circuits to fail. Magnetrol's tireless, friction-free magnetic force provides ultra-dependable switching action at all times. BOILER SAFETY KNOWS NO PRICE.

Schaub also builds Patented Heat-Reclaim and Spray-Type Deaerating Systems for exacting requirements from 10 to 1000 Boiler Horse Power. Write for new Schaub Catalog No. 55 which gives more information on all types of Schaub Systems.

FRED H. SCHAUB ENGINEERING COMPANY

2116 S. Marshall Boulevard • Chicago 23, Illinois

Give your jobs this Blue Ribbon Blower

And now Peerless shoots for new heights!

Peerless specifications already conform to three association standards. Still Peerless strives to improve its own "must" requirements to bring Peerless performance records beyond the usual.

Peerless makes its own blowers and motors—an important fact in design . . . more important when you need service!

Peerless engineering and development is based on 59 years of performance records in industrial, commercial and public buildings. That's why Peerless brings you improvements like these:

DYNAMIC BALANCE—for noiseless, vibrationless operation—long service.

COMPLETE SERVICE—Peerless builds fan and motor.

ON TIME DELIVERIES—save construction delays.

DIRECT SERVICE—from factory to you—from Peerless representative to factory.

When you need reliable, proven air moving equipment, specify Peerless . . . you get the best. Just call your Peerless representative for data.

Peerless Electric

Fan and Blower Division

THE PEERLESS ELECTRIC COMPANY

1409 West Market St. • Warren, Ohio

At your age!

If you are over 21 (or under 101) it's none too soon for you to follow the example of our hero, Ed Parmalee, and face the life-saving facts about cancer as presented in our new film "Man Alive!". You'll learn, too, that cancer is not unlike serious engine trouble—it usually gives you a warning:

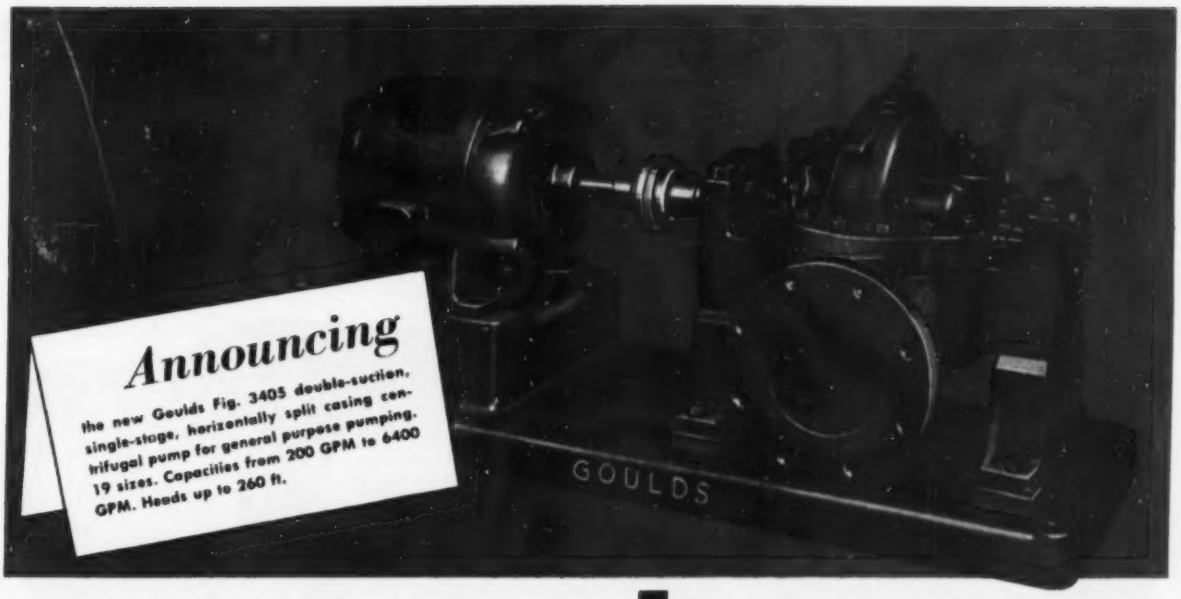
(1) any sore that does not heal (2) a lump or thickening, in the breast or elsewhere (3) unusual bleeding or discharge (4) any change in a wart or mole (5) persistent indigestion or difficulty in swallowing (6) persistent hoarseness or cough (7) any change in normal bowel habits.
While these may not *always* mean cancer, any one of them should mean a visit to your doctor.
Most cancers are curable but *only* if treated in time!

You and Ed will also learn that until science finds a cure for *all* cancers your best "insurance" is a thorough health examination every year, no matter how well you may feel—twice a year if you are a man over 45 or a woman over 35.

For information on where you can see this film, call us or write to "Cancer" in care of your local Post Office.

American Cancer Society

MAN ALIVE! is the story of Ed Parmalee, whose fear weakens his judgment. He uses denial, sarcasm and anger in a delightful fashion to avoid having his car properly serviced and to avoid going to a doctor to have a symptom checked that may mean cancer. He finally learns what a difference it makes (in his peace of mind and in his disposition) to know how he can best guard himself and his family against death from cancer.


Announcing
the new Goulds Fig. 3405 double-suction, single-stage, horizontally split casing centrifugal pump for general purpose pumping. 19 sizes. Capacities from 200 GPM to 6400 GPM. Heads up to 260 ft.
GOULDS

This new pump gives you 5 big cost advantages

The price you pay is only one element of the cost of a pump installation.

Good engineering practice also figures in the cost of pump breakdowns, low operating efficiency, changeovers to meet new conditions, replacement parts inventories, even the floor space the installation takes up.

Here's why the new Goulds centrifugal pump is designed to improve your cost experience in every one of those elements.

1. ***It combines seven design features that mean maximum operating efficiency and minimum maintenance.***

Every one of these construction features is standard with this new design. Together they offer you, without extra cost, a quality of service that's unique in its approach to general liquid handling.

a. Renewable stuffing box bushings.
b. Bearing housings sealed against moisture and dirt.
c. Cowl-type glands suitable for use with quenching liquids.
d. Stainless steel impeller keys.
e. Teflon water seal rings.
f. Die-formed stuffing box packing.
g. Corrosion resistant gland bolts.

2. ***Interchangeability of parts.***

With only three shaft and rotating parts assemblies to provide for 19 pump sizes and 38 pump combinations, this new design offers you a remarkable range of interchangeable parts. A glance at the interchangeability chart on page 7 of the descriptive bulletin will show you:

a. how this design gives you great flexibility in making field changes should your pumping requirements change;
b. why the first cost of this unit is so low due to standardization in manufacture; and
c. how this interchangeability helps to reduce spare parts inventories.

3. ***Compact construction.***

You will be particularly pleased with the short over-all length of this new design. Short bearing spans cut lengths as much as 50%. This means a real saving in floor space.

4. ***Flexibility of stuffing box.***

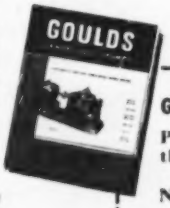
You can use either conventional stuffing boxes or mechanical seals depending on requirements. And you can change from one to the other in the field if need be.

5. ***Easy rotation change.***

A unique device, locking shaft seals, permits you to change from right-hand rotation to left-hand rotation or vice versa in the field without construction changes.

More than 50 years of experience in meeting industry's needs for general purpose centrifugal pumps come to a climax in this design.

GET FULL DETAILS **This 12-page illustrated bulletin, No. 721.6, covers the complete details of the new Goulds Fig. 3405, including specifications, interchangeability tables and performance curves. Be sure you have the whole cost-advantage story before you select another general purpose pump. Contact your nearest Goulds representative or mail the coupon below today.**



GOULDS PUMPS, INC., Dept. HP, Seneca Falls, N.Y.

Please send me Bulletin No. 721.6 describing the new Fig. 3405 centrifugal pump.

Name_____

Company_____

Address_____

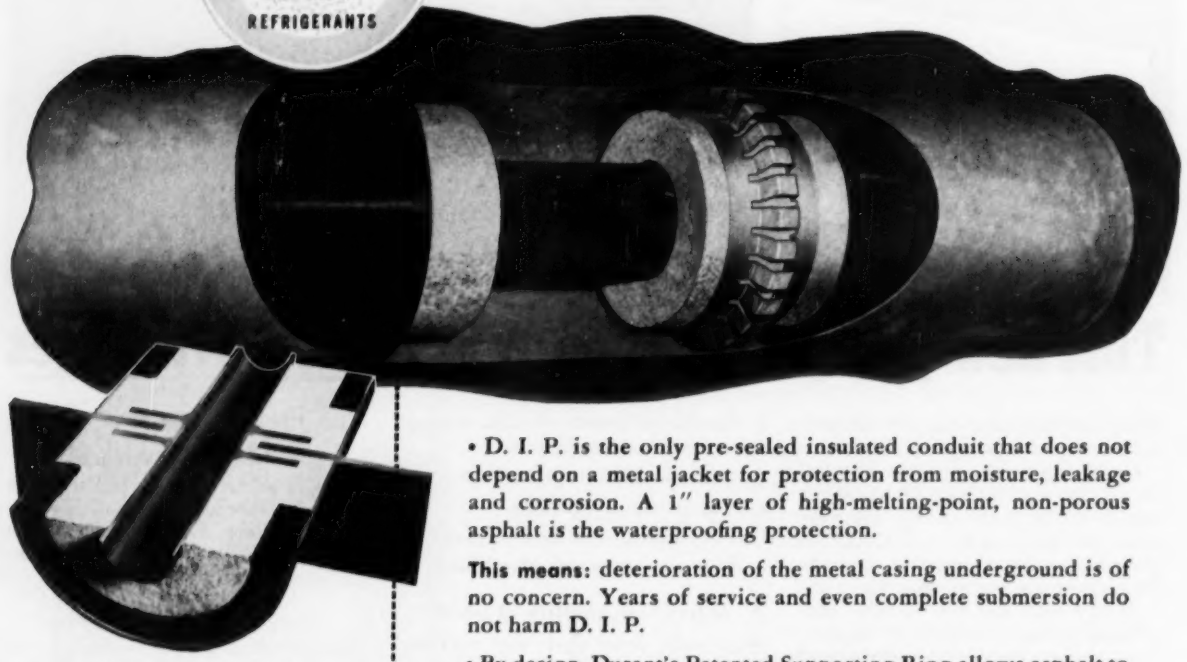
City_____ State_____

Goulds PUMPS INC. Seneca Falls New York

Only DURANT Pre-sealed Insulated Pipe gives you these features:

D.I.P.®

FIRST IN THE FIELD OF PRE-SEALED INSULATED PIPING FOR STEAM HOT WATER REFRIGERANTS



Durant Patented Insulated Anchor

Inspection of D. I. P. after 15 years' service revealed no sign of corrosion, no loss of insulation efficiency, no breaks in asphalt. Note backfill of refuse building materials. Installation is on former city dump.

• D. I. P. is the only pre-sealed insulated conduit that does not depend on a metal jacket for protection from moisture, leakage and corrosion. A 1" layer of high-melting-point, non-porous asphalt is the waterproofing protection.

This means: deterioration of the metal casing underground is of no concern. Years of service and even complete submersion do not harm D. I. P.

• By design, Durant's Patented Supporting Ring allows asphalt to flow through openings during fabrication to *encase* the ring.

This means: water or moisture cannot pass through support points to the insulation or pipe. It means efficient insulating properties and extreme durability.

• Durant's Patented Insulated Anchor eliminates contact between anchor plate and pipe.

This means: reduced heat loss and elimination of corrosive electrolytic action at anchor points.

Many other advantages come with D. I. P.—such as low cost installation, for the Durant field joint can be made swiftly and easily. D. I. P. does not require external casing-welding: nor does it require concrete tunnels, slabs, rollers, supports, drains or additional protection for superimposed loads—such as under roadways or railroad tracks. Steam pressures to 1000 psi.

Durant's engineering staff and representatives are at your service. Write us today for Catalog 2-A.

Representatives in Principal Cities

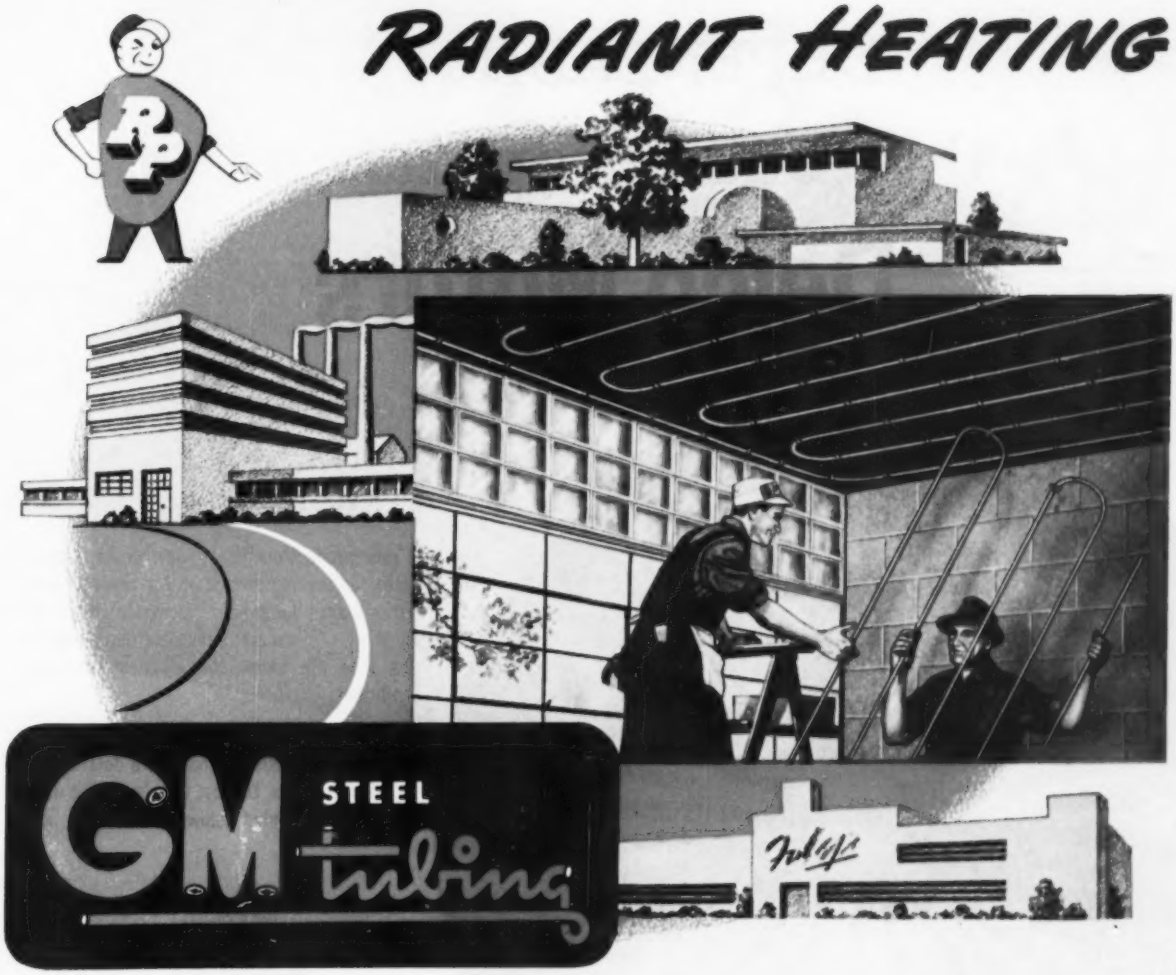
PRE SEALED®

Western Division: **DURANT INSULATED PIPE COMPANY**
PALO ALTO, CALIFORNIA

Eastern Division: **DURANT INTERNATIONAL CORPORATION**
WILLIAMSTOWN, NEW JERSEY

THE RIGHT ANSWER FOR

RADIANT HEATING



Just as more and more building plans call for radiant heating, so do their installation "specs" call for the use of *steel* tubing . . . and particularly GM Steel Tubing. That's because it combines lasting quality, adaptability and low cost. Check the features and you'll find that *only GM Radiant Heating Tubing* offers all these advantages:

LOW MATERIAL COST—yet meets the strict requirements for radiant heating. GM Steel Tubing is *all steel*—no secondary bonding alloys to encourage electrolytic corrosion.

LOW HANDLING COST. 120′ to 1000′ continuous coils *eliminate fittings and joints* in plaster and under grade—reduce labor costs and, at the same time, lessen chance of leakage.

HIGH QUALITY, STRENGTH and UNIFORMITY. Every foot of GM Steel Tubing is hydrostatically tested at 2000 pounds per square inch. In addition, sections are subjected to "destructive" tests such as flaring, twisting, flattening, etc. Such tests assure you of quality and uniformity.

SMALL, YET TOUGH. GM Steel Tubing is small enough for easy handling, yet tough enough to be walked on or roughly handled without damage. Complete serpentine coils can be readily formed in heating contractor's shop or at building site.

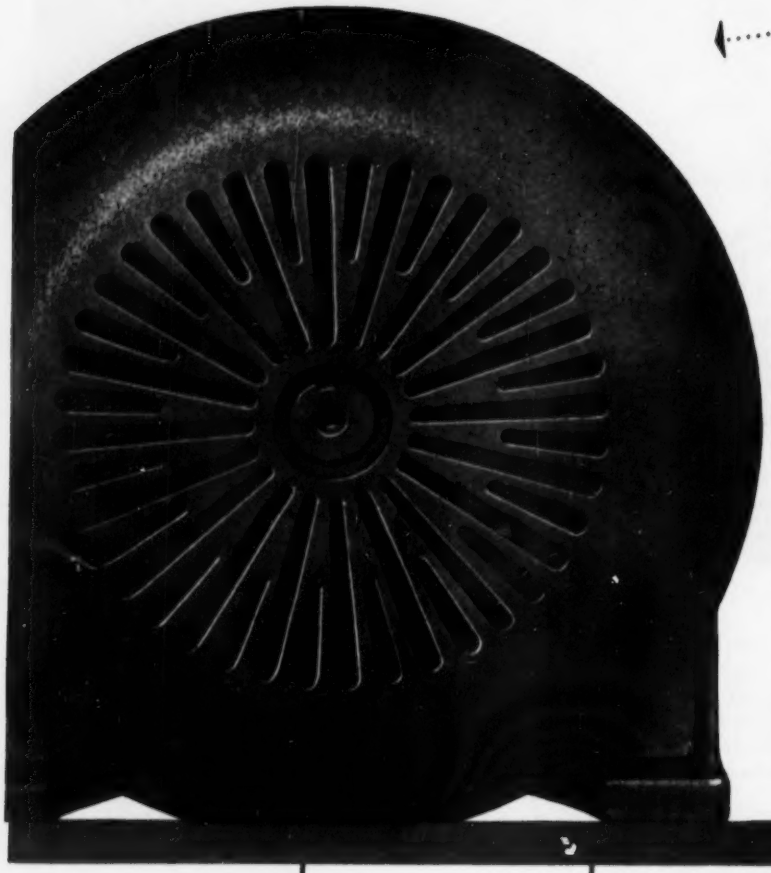
SEND FOR YOUR FREE BROCHURE

Entitled *"A New Approach to Radiant Heating,"* this profusely illustrated Rochester Products brochure tells why GM Steel Tubing is the choice of more and more progressive builders. Send today for your free copy.

ROCHESTER PRODUCTS *DIVISION OF GENERAL MOTORS*
Rochester, N. Y., U. S. A.

GM STEEL TUBING

DEPENDABILITY...
that builds reputation
Delco Motors



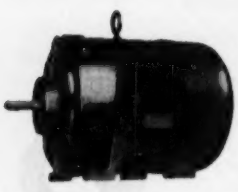
If your product needs a power source, look to Delco for the motor that will serve you best. Delco makes motors for most industrial applications . . . motors famous for dependability and long life under the toughest operating conditions.

So . . . check on Delco. You'll find a Delco motor that fits your needs. For complete details write to Delco Products, Dayton, Ohio, or to the nearest sales office listed below.

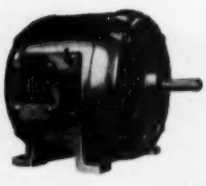
DELCO DAYTON OHIO

DELCO PRODUCTS

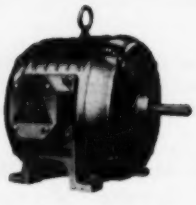
Division of General Motors Corporation
Dayton, Ohio



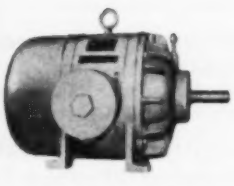
Totally Enclosed Fan-Cooled Motor



Open Ball-Bearing Motor

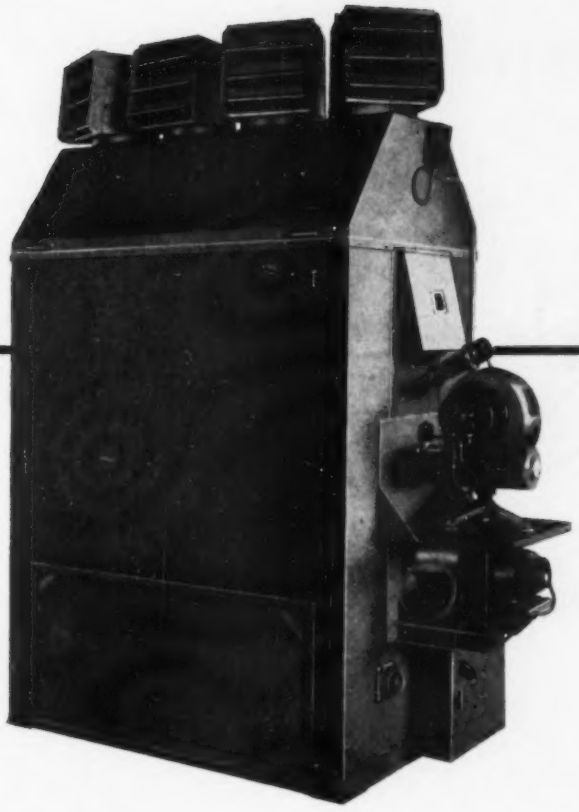


Totally Enclosed Motor



Explosion-Proof Motor

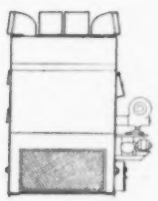
SALES OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis • San Francisco



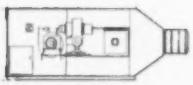
FOR *Flexibility*

Here's a full size heater with all the important features and still the flexibility of a tea cart. Where valuable floor space is at a minimum it is a simple matter to mount an Olson to the wall or suspend it from the ceiling. The efficiency of this heater remains effective in any position whether it be horizontal or inverted. Olson engineers can even furnish a heater that can be moved from place to place in a large space where it is desirable to heat one area at a time.

There is an Olson Heater to meet most any heating requirement for space heating and special adaptions. The initial cost is low and the installation is simple . . . the operation is completely automatic and constant attention can be eliminated.



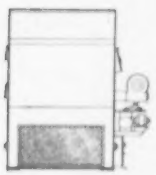
FLOOR MODEL



HORIZONTAL MODEL

INVERTED MODEL

RETURN AIR DUCT



DUCT TOP

ARTHUR A. OLSON & COMPANY

BROAD ST. CANFIELD OHIO

Mail this coupon for further information about sizes and ranges, detailed operation.

Representatives in principal cities.

ARTHUR A. OLSON & COMPANY
CANFIELD, OHIO

Please send me Olson Direct Fired Heater Catalog.

Name.....

Firm.....

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JENKINS PRACTICAL PIPING LAYOUTS

65

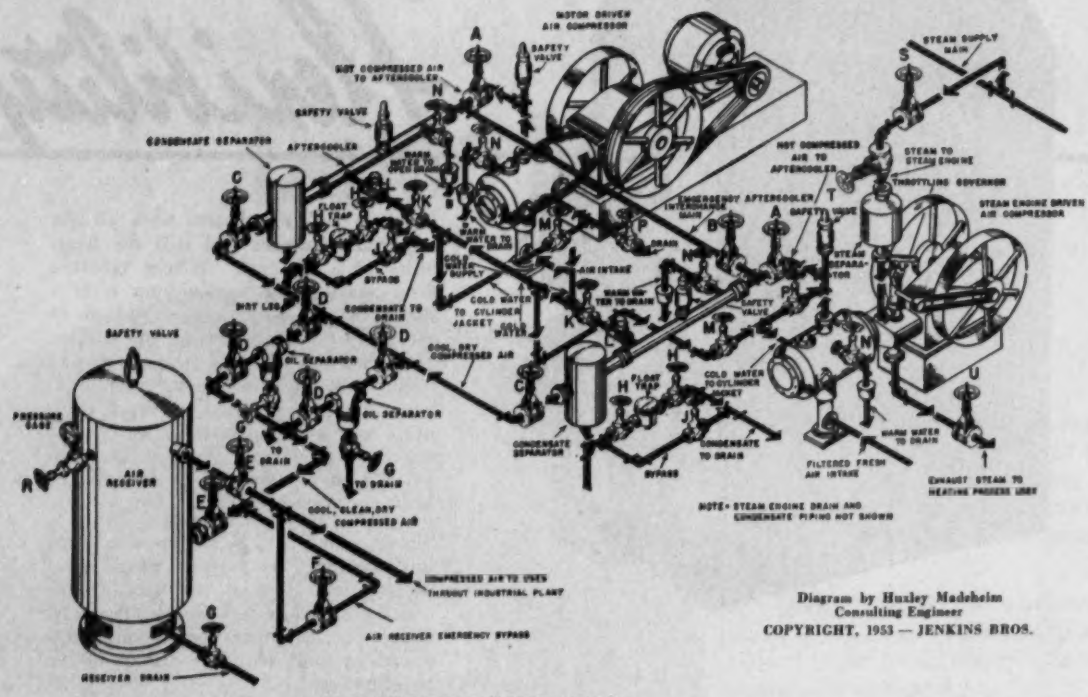


Diagram by Huxley Madeheim
Consulting Engineer
COPYRIGHT, 1953 — JENKINS BROS.

VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions.

Code	Quan.	Jenkins Valves	Service
A	2	Fig. 651-A I.B.B.M. Gate	Compression Discharge Shutoff
B	1	Fig. 651-A I.B.B.M. Gate	Emergency Changeover Line
C	2	Fig. 651-A I.B.B.M. Gate	After Cooler Shutoff
D	4	Fig. 651-A I.B.B.M. Gate	Oil Separator Shutoff
E	2	Fig. 651-A I.B.B.M. Gate	Air Receiver Shutoff
F	1	Fig. 651-A I.B.B.M. Gate	Air Receiver Shutoff
G	3	Fig. 106-A Bronze Globe	Drain Line
H	4	Fig. 950 Bronze Globe	Trap Shutoff
J	2	Fig. 950 Bronze Globe	Trap By Pass
K	2	Fig. 106-A Bronze Globe	Cold Water Control
L	2	Fig. 352 Swing Check	Prevent Backflow
M	2	Fig. 106-A Bronze Globe	Cold Water Control
N	4	Fig. 106-A Bronze Globe	Drain Shutoff
P	2	Fig. 106-A Bronze Globe	Drain Shutoff
R	1	Fig. 744-G Needle Angle	Pressure Gage Control
S	1	Fig. 204 I.B.B.M. Gate	Steam Supply Line
T	1	Fig. 923 I.B.B.M. Globe	Steam Engine Shutoff
U	1	Fig. 651-A I.B.B.M. Gate	Engine Exhaust Shutoff

How to plan PIPING CONNECTIONS FOR AN INDUSTRIAL PLANT AIR COMPRESSOR

Compressed air is more economically supplied from a central installation in plants where demand is extensive. In such a system, the highest single pressure requirement in the plant determines the number of compression stages needed, and local pressure reducing stations meet the requirements of specific operations.

A single stage system is shown in this layout. Equipped with electric and steam driven compressors, this installation can develop 125 p.s.i. The former usually serves as a stand-by unit, but both can be used jointly for heavy load conditions.

The compressed air, after leaving the compressors, passes through a water-cooled after-cooler, which lowers air temperature and condenses moisture. The air then goes through oil separators and on into the air receiver, which decreases pressure pulsations and serves as a storage reservoir.

A capacity reduction device helps control load fluctuations in the constant-speed electrically driven compressor. In variable speed steam driven compressors, the throttling governor responds to load changes.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of lowest cost in the long run. Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 65.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864
JENKINS
Jenkins Bros

EQUIPMENT DEVELOPMENTS...

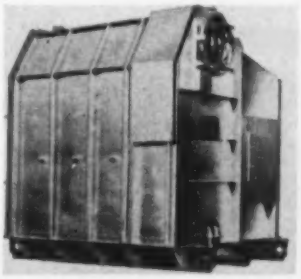
Car Conditioning

HPAC 1—"Frigidaire" car conditioning unit designed to drop automobile interior temperature to a comfortable level even when outside temperature is over 100 deg F . . . "Freon 12" is the refrigerant. The condenser is located in front just ahead of the radiator, while to its right is a rotary compressor run by a dual pulley off the crankshaft. A sealed-in refrigeration unit, containing an electric

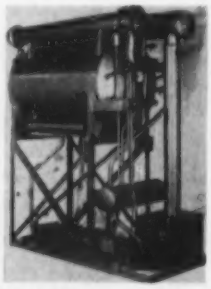
motor, two blowers and an evaporator case, is mounted on the ledge in the rear trunk. Two ducts extending the length of the passenger compartment under the windows distribute the air evenly to all parts of the car interior through 1500 perforations and four manually adjusted air vents. Two air return ducts are located near the center of the shelf behind the rear seat. [Manufacturer: Oldsmobile Div., General Motors Corp., Lansing 21, Mich.]

Package Boiler

HPAC 2—Package type water tube boiler designed for steam and high temperature hot water. . . . The boilers are offered in sizes ranging from 7500 to 30,000 lb of steam per hr and in design pressures of 200, 300, 600 and 900 psig. All are of a two-drum, bent tube design, featuring a water cooled furnace in which tangent water tubes shield the combustion chamber. Provision for heat up to 200 F is available. Firing is by oil or gas or combination burners. [Manufacturer: Springfield Boiler Co., 1939 E. Capitol Ave., Springfield, Ill.]



Boiler



Chiller

Water Chiller

HPAC 3—Ten-ton water chiller designed to supplement the company's 25-ton model. . . . The absorption-type unit is a hermetically-sealed vacuum system that operates with no moving parts and requires no field assembly. Steam is the source of energy. Another new product offered by the firm is the "Wonderair" window-type room air conditioner which features single-knob operation. Four grilles control the directional flow of air. It is available in ¾ and 1 ton sizes. [Manufacturer: Servel, Inc., Evansville 20, Ind.]

Handwheel for Valves

HPAC 4*—"Non-Slip" handwheel to provide for a firm grip in applying high pressure. . . . Four finger-spaced lugs, all continuations of the spoke structure, project from the stem hub through an octagonal frame. The shape of the handwheel is designed to eliminate the possibility of burned hands from contact with the valve stem. [Manu-

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [2-53]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments.

(Circle each HPAC number in which you are interested)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24

Name _____ **Title** _____

Company _____

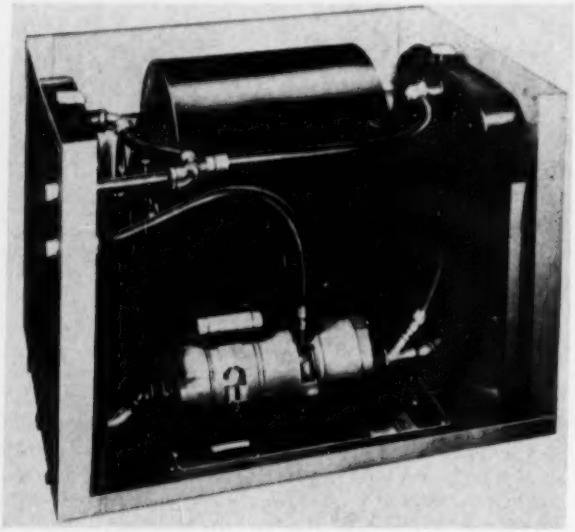
Address _____

City _____ **Zone** _____ **State** _____

facturer: The Lunkenheimer Co., Waverly and Beekman Sts., Cincinnati 14.]

Water-Cooling Unit for Conditioners

HPAC 5*—Water-cooling and recirculating unit for 3 hp packaged residential and small-store conditioners. . . . The "Water Saver" is designed to take the place of the outside water supply in the air conditioner. The sealed-in water coolant prevents scaling and corrosion. Two automotive type radiators, a ½ hp pump and high capacity



blower comprise the unit's moving parts. These parts are mounted on rubber, and interior water connections are heavy-duty rubber hose. Electrical connections are made directly to the conditioner control box. Blower fan speeds can be increased or decreased by an adjustable motor pulley. [Manufacturer: Chrysler Airtemp, Div. of Chrysler Corp., 1600 Webster St., Dayton 1, Ohio.]

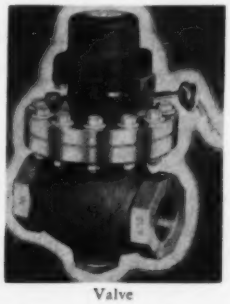
Flexible Insulation Material

HPAC 6—"Ultrafine," thermal and acoustical insulation of glass fiber. . . . According to the manufacturer, it is fire resistant, will not rot, mold or decay, resists vibration, has no odor and is not corrosive to metals. It is available in rolls, plain or with a vapor barrier facing, or can be die-cut for special shapes. Adhesives, wire, staples or jute twine hold it in place. The insulating material is designed to be used on heating equipment up to 450 F. [Manufacturer: Gustin-Bacon Mfg. Co., 210 W. 10th St., Kansas City 6, Mo.]

Electric Unit Heaters and Heater Sections

HPAC 7*—Unit heaters and heater sections, incorporating electric heating elements, designed for applications where steam, hot water or gas is not available. . . . Featured is an arrangement of flexibly mounted insulators suitable for service up to 6000 volts. Three types of heaters available are: ceiling-suspended, downward discharge heater with revolving discharge outlets; ceiling-suspended, downward discharge heater with stationary discharge outlets; horizontal discharge heater with adjustable vanes where the use of steam lines is not feasible. The duct heater section is designed to be applied to a run of duct, for process heating or replacing exhausted air with fresh tempered air, where steam or hot water is not available or economical. [Manufacturer: L. J. Wing Mfg. Co., 140 Vreeland Mills Rd., Linden, N.J.]

Revolving Heater



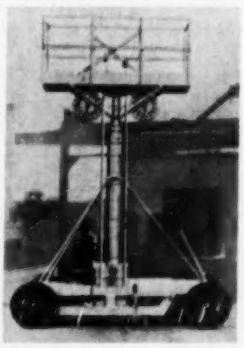
Valve

Solenoid Valves

HPAC 8—Solenoid valve for high pressure lines. . . . The valves are made in sizes from ½ in. to 1½ in. and for pressures to 3000 psi. Designed with three moving parts and no external linkage, normal valve maintenance is said to be further reduced by the packless construction. Coil housings for various conditions are offered in dust-tight, water-tight or explosion-proof housings for use in hazardous atmospheres. [Manufacturer: Atkomatic Valve Co., Dept. 47, 545 Abbott St., Indianapolis 25.]

Hydraulic Lift

HPAC 9**—Mobile hydraulic personnel lift with hydraulic jack. . . . According to the manufacturer, a working crew can raise itself or 6000 lb of building material 38 ft above ground on the 8 ft platform by means of dual hydraulic controls. The platform can be rotated 360 deg from the top. Fully retracted, the lift with guard rail collapsed, requires 13 ft, 6 in. clearance. The base is equipped with four stabilizing screw jacks on folding arms for use with heavy loads and high lifts. [Manufacturer: Hamlin-Klock Corp., 28 N. Marengo Ave., Pasadena 1, Calif.]



Above: Ball Valve

Left: Lift

Venturi Ball Valves

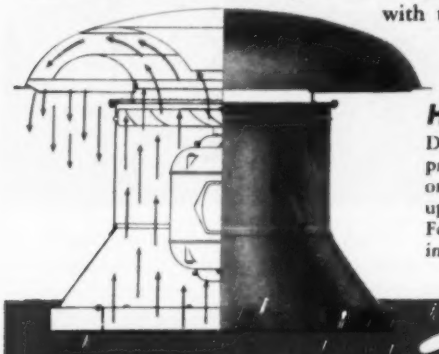
HPAC 10*—Venturi valve in which the disc is a ball. . . . The ball is not attached directly to the stem, but rides in a cage which is attached to the stem by a tee-head slotted construction. The ball is moved to and from the center of flow and rolls into and out of the body seat. The ball disc is mechanically locked in the closed position by a wedging member on the cage. In moving to the

(Photo courtesy of National Biscuit Company)

Smart Cookies LIKE NABISCO CALL FOR Controlled Ventilation

At Portland, Oregon, the modern National Biscuit Company plant is one of the most scientifically equipped food producing establishments in the world. But you can imagine how hot it could get around ovens that turn out several million cookies a day! Plant designers Ford, Bacon and Davis anticipated the need for exhausting hot air caused by baking processes, and came up with the right recipe. 42 DeBothezat Power-Flow Roof Ventilators, each with 21" fan wheel and 1 HP totally enclosed air-over motor, were installed over the oven area. 19 Power-Flows with 27" fan wheel and 1 HP motor were installed above the packaging and shipping areas. Altogether these 61 Power-Flow Roof Ventilators exhaust more than 445,000 cubic feet of air per minute. Controlled ventilation assures good working conditions, and is in keeping with the high standards of NABISCO operation and sanitation.

Certified Ratings



HOW ABOUT YOUR PLANT?.

DeBothezat Power-Flow Roof Ventilator is a motor-driven fan in a weatherproof housing, for use with or without duct systems, either for air exhaust or intake. Available with fan wheels 12" through 48" in diameter, delivering up to 40,900 CFM. Low, streamlined design blends well with all architecture. For catalog containing illustrations, specifications and certified capacity ratings, write our factory, Dept. HP-253, or phone your local DeBothezat agent.

Power-Flow ROOF VENTILATORS

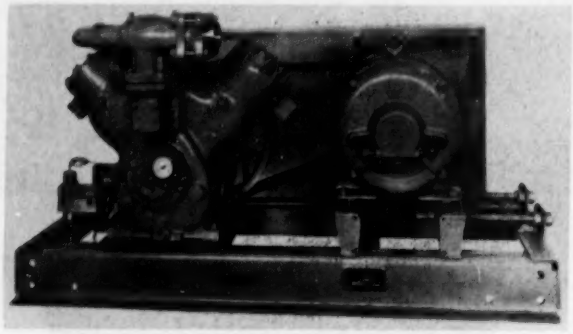
Built by **DeBothezat Fans**

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

fully open position, the ball rolls out of the seat and up, until it is lined up vertically with the stem and is carried out of the path of flow. It is designed to provide accurate flow control with a minimum of wire-drawing, straight-through flow with a low pressure drop, tight shut-off and freedom from vibration or chattering. [Manufacturer: Crane Co., 836 S. Michigan Ave., Chicago 5.]

Air Conditioning Products

HPAC 11—Several new air conditioning and refrigeration products. . . . Window-type room air conditioner in ¾ and 1-ton sizes with one-dial control, directional air flow and automatic step-down control for night operation; reciprocating compressor and condensing units for "Freon 12", "Freon 22" and ammonia, for air conditioning and refrigeration applications, with capacities ranging from 3 to 150 tons; a packaged liquid cooling unit for air



Compressor Unit

conditioning and industrial process applications containing compressor, drive base, condenser, chiller, heat exchanger, piping and controls; room air conditioners, floor and ceiling mounted, for use with central systems. These units heat or cool with water piped from a central source and are available in capacities of 200, 400 and 600 cfm. [Manufacturer: Worthington Corp., Harrison and Worthington Sts., Harrison, N.J.]

Wire Braided Steam Hose

HPAC 12—"Ironside" steam hose combining wire braided and glass cord construction. . . . Designed to be flexible and kinkproof and for working pressures up to 200 lb, sizes range from ½ in. to 1¼ in. inner diameter. [Manufacturer: Quaker Rubber Corp., Div. of H. K. Porter Co., Inc., Tacony and Comly Sts., Philadelphia 24.]

Overload Relay

HPAC 13**—Overload relay with sealed silicone time element. . . . The Type C "Silic-O-Netic Relay" has a hermetically sealed brass tube extending through and beyond the solenoid coil. The tube, in turn, holds a movable iron core and is filled with a silicone liquid. On starting inrush or small overloads, the magnetic force is not sufficient to attract the armature. It does, however, draw the core into the field at a rate controlled by the viscosity of the silicones. When the core reaches the pole piece the relay responds, providing delayed response. On large overloads, the core is not a factor and relay operation is designed to be instantaneous. According to the manufacturer, the overload relay combines high speed operation under dangerous conditions with time delay for starting inrush. [Manufacturer: Heinemann Electric Co., 349 Plum St., Trenton 2, N.J.]

Packless Valve

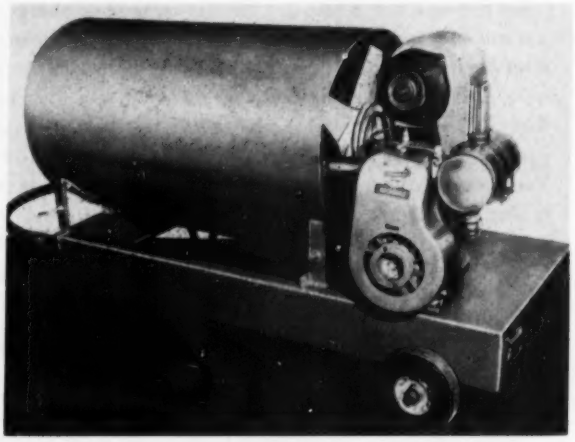
HPAC 14**—"Demi-G" packless, tamper proof, globe valve for hydraulic, pneumatic or vacuum service. . . . Pressures up to 1500 psi in brass and aluminum and higher pressures in other materials. It can be applied to oil, water, gas and corrosive systems. The diaphragm is sealed in place between the bonnet and gasket and retained by swagging. The valve is operated by the actuator thrusting the button against the diaphragm which seals the inlet port. [Manufacturer: George W. Dahl Co., Inc., Bristol, R.I.]

Polyethylene Pipe and Tubing

HPAC 15—"Agilene 'CP'" unpigmented, chemically pure, polyethylene pipe and tubing. . . . It is translucent so that observation of liquid levels and general flow conditions is possible. One in., 1½ in. and 2 in. N.P.S. diameter pipes are furnished in straight 20-ft lengths. Tubing is available from ¼ in. ID to 3-in. ID with the ¼-in. through 1 in. diameter sizes furnished in coils. Larger tubing is furnished in multiples of individual 4-ft sections joined by hot gas welding. [Manufacturer: American Agile Corp., P.O. Box 168, Bedford, Ohio.]

Gasoline Engine Driven Space Heater

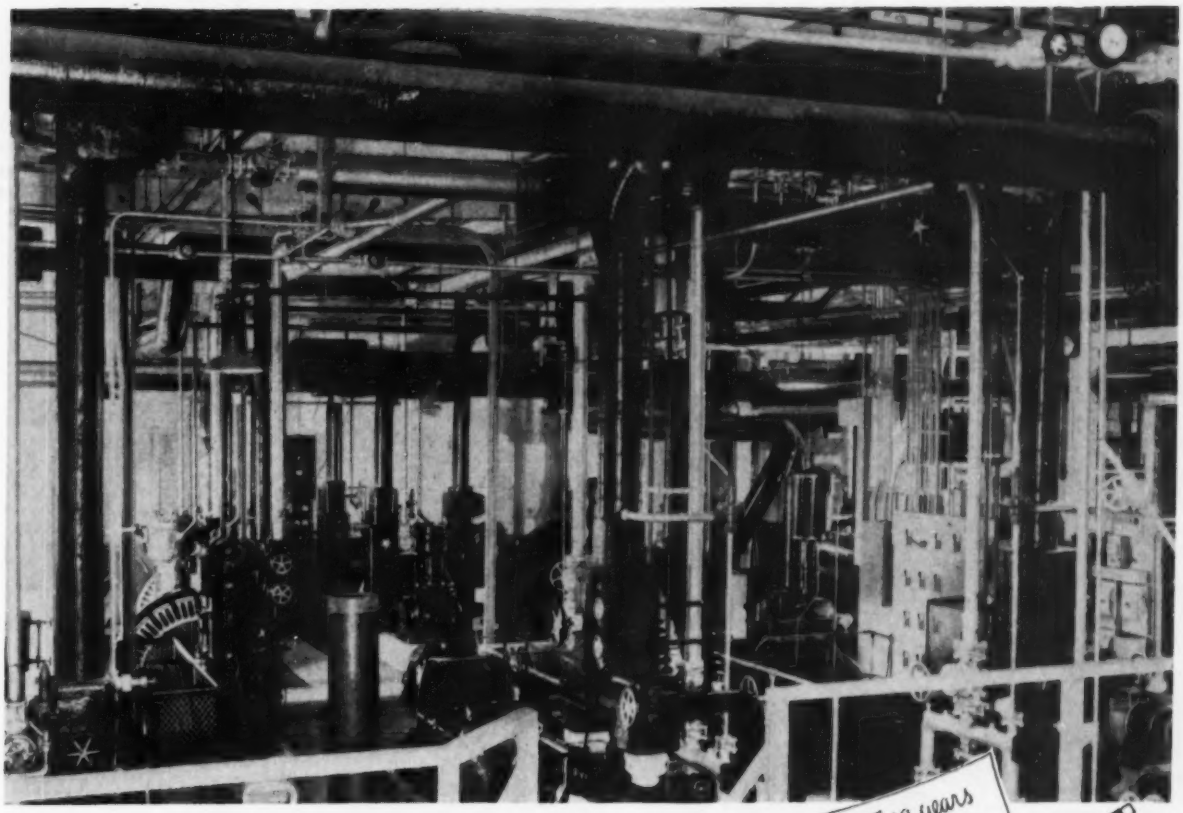
HPAC 16*—Portable space heater run by a small gasoline engine. . . . The heater, in two sizes, is rated at 200,000 and 400,000 Btu. A connection line to an oil drum supplies fuel for the burner. Combustion is effected to

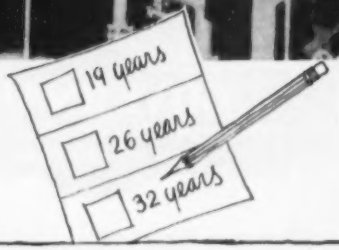


the point where a stack is not required. According to the manufacturer, starting of the burner is instantaneous. [Manufacturer: Quiet Automatic Oil Burner Corp., 33 Bloomfield Ave., Newark, N.J.]

Pressure Relief Valve

HPAC 17**—Cartridge type pressure relief valve. . . . Designed to be insensitive to back pressure or system pressure, it is applicable for aircraft use and other industrial uses. The valve is not a bias across the line. According to the manufacturer, it eliminates the effects of system or back pressure so that relief pressure stays constant over a wide range of back pressure. [Manufacturer: Pantex Mfg. Co., Hydraulics Div., Pawtucket, R.I.]





How old is the cork insulation on these cold lines?

A good insulation job seldom shows its age. The cork covering on these cold lines, for example, seems almost new. It still fits tightly, is highly efficient, and shows no signs of deterioration. Yet this job was installed in 1927—26 years ago.

These cold lines at the Security Warehouse and Cold Storage Co., Santa Clara, California, were insulated with Armstrong's Cork Covering, applied and finished according to standard specifications. The only maintenance needed in 26 years has been an annual application of Armstrong's No. 1 Asphalt Paint. The covering is doing a fine insulating job and promises many more years of economical service.

This job is by no means unusual. It's one of hundreds where Armstrong's Cork Covering is still performing at peak efficiency after 20, 30, and even 40 years.

It takes skilled application as well as top-quality materials to deliver long, trouble-free service like this. That's why it's a good idea to call Armstrong whenever you're planning any low-temperature work. Armstrong's complete contracting group can take over the entire job for you—from specifications to application. You're assured of thoroughly professional work that gives years of low-cost service. For further information, just call your near-by Armstrong office or write Armstrong Cork Company, 4402 Concord Street, Lancaster, Pennsylvania.

Complete Insulation Contract Service

There are many factors that can't be written into an insulation contract, but which can largely determine whether or not the agreement will be entirely satisfactory. They include:

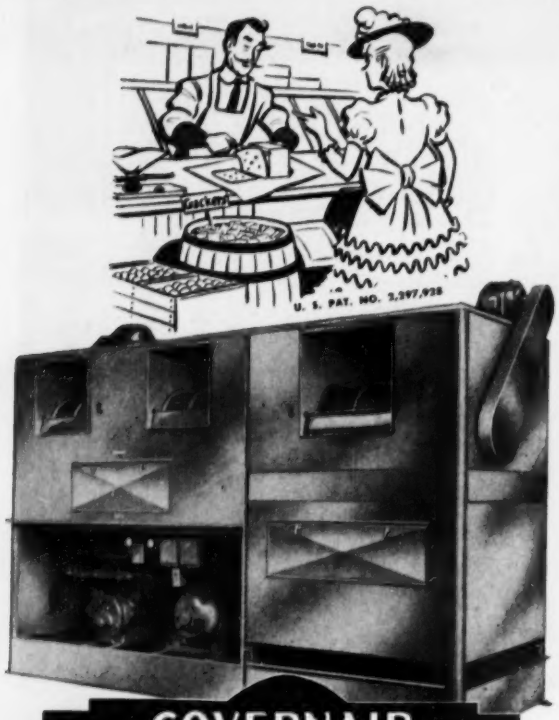
1. Financial responsibility—resources to complete the contract despite any unforeseen events.
2. Integrity—a reputation for quality work and for prompt settlement of any justified complaints.
3. Technical ability — experience, plus technical and research staff to do the job in accordance with best practices.
4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.
5. Efficiency — ability to deal with problems of accounting, tax provisions, insurance, and workmen's compensation.

You get all these with an Armstrong Contract

ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.

Packaging has improved lots of things

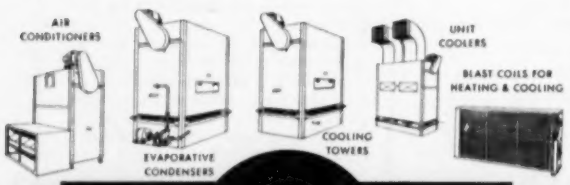


GOVERNAIR
ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

Packaging makes many products more efficient, more convenient and more acceptable these days. And large size packaged air conditioners (up to 60 tons) are no exception!

That's why *so many* Governair Completely Packaged Air Conditioners are in use today. They are engineered and built by the pioneers of large size packaged air conditioning — *Governair!*

If you want a package deal that will do a better job of air conditioning for you choose Governair! Sized from 3 to 60 tons. GOVERNAIR CORPORATION, 513 N. Blackwelder, Oklahoma City, Okla.

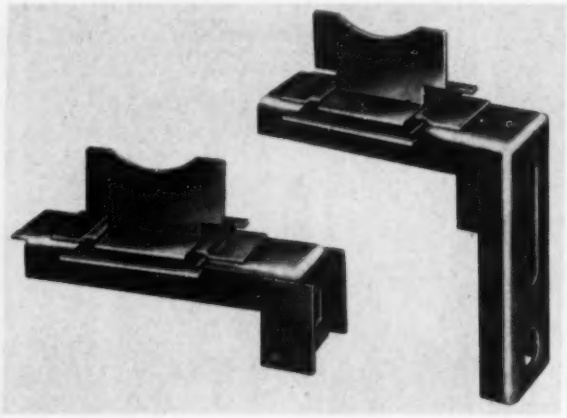


GOVERNAIR

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS!

Hangers for Fin-Tube Radiation

HPAC 18*—Adjustable hangers with a sliding cradle to permit expansion and contraction of heating elements. . . . Hangers are said to be suited for fin-tube radiation having 1¼ in. and 2 in. tube sizes. The sliding cradle fits either pipe size and provides a maximum travel of ¾ in. to accommodate the expansion and contraction of heating



elements. According to the manufacturer, this eliminates rappings and noises caused by pipe movement, and prevents the expanding elements from tearing out anchor bolts. [Manufacturer: Radiant Ray Radiation, Inc., 900 W. Main St., New Britain, Conn.]

Multi-Speed Motors

HPAC 19—Single unit which can be operated at different speeds. . . . Motors are available in 2, 3 or 4 speeds in either constant torque, variable torque or constant horsepower types. The constant torque may be used for, among other things, air compressors. Typical applications for the variable torque are fans, blowers and centrifugal pumps. Ranging from ½ hp to 150 hp, the motors are furnished in either standard, totally enclosed, splash-proof or explosion-proof designs. [Manufacturer: Reuland Electric Co., 3001 W. Mission Rd., Alhambra, Calif.]

Boiler Level Indicator

HPAC 20—Liquid level indicator for use in boiler rooms. . . . Twelve-in. dial indicator, operating on the differential pressure principle, may be mounted on a panel or pipe standard to bring it to eye level. According to the manufacturer, the large white numerals and micrometer pointer against a dull black dial provide accurate reading at a distance or in dim light. Available in standard ranges from 0-20 to 0-200 in. of water, parts are factory tests for safety at 4000 psi. Rated working pressure is 2000 psi. [Manufacturer: The Foxboro Co., 106 Neponset Ave., Foxboro, Mass.]

Screw Extractors

HPAC 21*—Screw extractors for removal of broken screws, bolts, studs or threaded forms without injury to the tapped threads. . . . They are available in nine sizes, individually packaged or in sets in a maple block stand. [Manufacturer: J. H. Williams & Co., 400 Vulcan St., Buffalo 7.]

YOUR finest workmanship will go to waste unless it's combined with the highest quality material you can obtain. For ductwork installations, that means U·S·S Galvanized Steel Sheets.

True bends, tight seams and neat joints—all the characteristics of a top-notch job—are quick and simple with these quality sheets. Bending, rolling, cutting, stamping and soldering can be accomplished in minimum time with the most satisfactory results.

For finest performance—both in the fabricating shop and on the finished job—make it a point to use U·S·S Galvanized Steel Sheets. And tell your customers the brand you're using; they recognize that the U·S·S name stands for the best in steel.

U·S·S GALVANIZED STEEL SHEETS

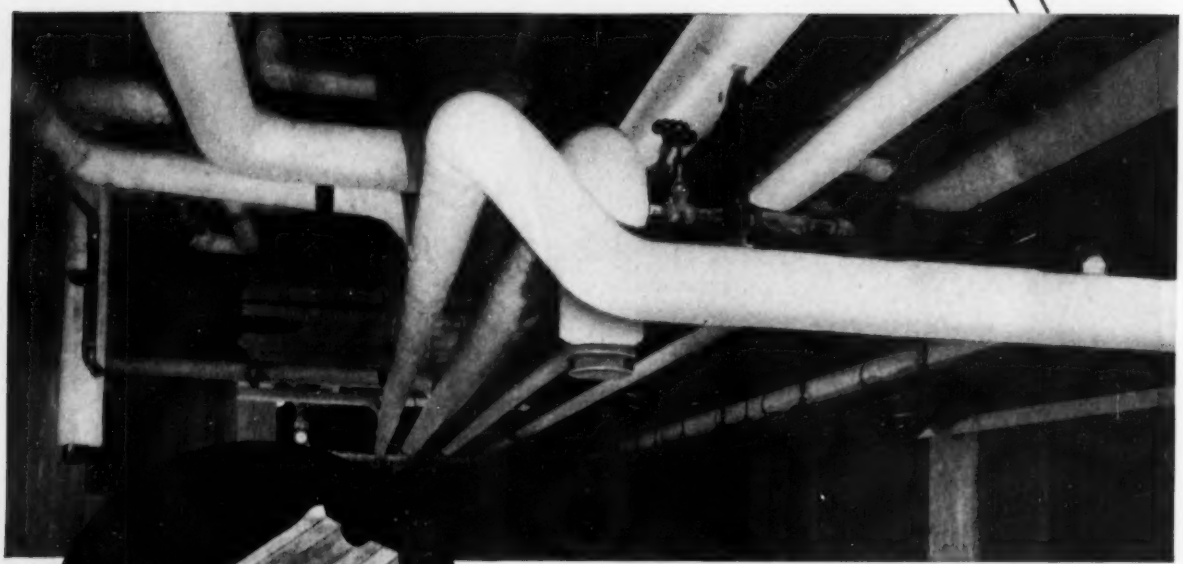
UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

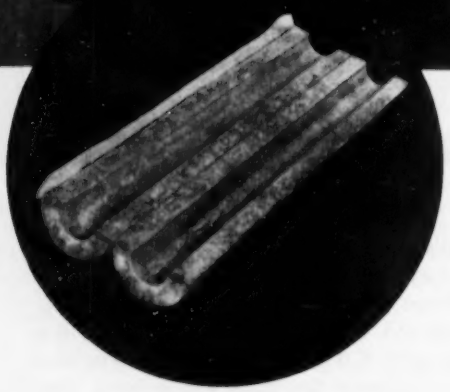
2-1267

USS

UNITED STATES STEEL

take a long look at the insulation you never have to look after.... Amocel





That's right! Unarco Amocel is as maintenance-free as an insulation can be—light, strong, durable ,efficient. It's unharmed by moisture, steam, fumes; withstands impact and vibration; may be removed and reused repeatedly without damage or efficiency-loss.

Amocel, a Unarco exclusive, brings to commercial insulation applications many of the excellent features already made famous by Unarco Unibestos—the higher-temperature stand-out. You'll like its easy installation, its clean appearance, its year-after-year effectiveness.

UNARCO

your Unarco Distributor has Amocel

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UNION ASBESTOS & RUBBER COMPANY

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LIVERPOOL, N. Y.
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P. O. Box 187

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119 Barclay Street

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Chart Drive

HPAC 22*—"Macnick" pneumatic chart drive for panel installations in hazardous locations. . . . Made for strip chart "Tel-O-Set" recorders, it is constructed of a sealed escapement mechanism, a gear reduction unit incorporating an impulse wheel and a two-way clutch assembly. These are assembled into a unit about the same size as the standard electrical chart drive. The self-starting escapement mechanism is located on top of a gear reduction unit to protect it from a contact with the driving air stream and it is sealed with a plastic cover. Air is supplied to the pneumatic drive through copper tubing connected to the rear of the recorder where an electrical connection is usually made. An additional 10 in. of flexible rubber tubing permits the drawer-type chassis to be partially withdrawn without breaking the air connection. [Manufacturer: Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44.]

Colored Plastic Pipe

HPAC 23—Yellow plastic pipe for easy visibility and identification. . . . The color, which goes all through the plastic material, is designed not to fade or stain under any conditions or rust, rot or corrode. [Manufacturer: The Plastex Pipe & Extrusion Co., 402 Mt. Vernon Ave., Columbus 3, Ohio.]

Ultraviolet Lamp

HPAC 24—High-intensity ultraviolet lamp for installation in air conditioning systems. . . . The "Safe-T-Aire" lamp is designed to create germ-free air to protect humans against infectious diseases and products against contamination. It is installed in regular air ducts where the circulating air is exposed to ultraviolet radiations which destroy bacteria, viruses and mold spores. In addition, it can be installed in multiples as well as singly to sterilize a volume of air from room size to entire plant air conditioning systems. [Manufacturer: Hanovia Chemical & Mfg. Co., 100 Chestnut St., Newark, N.J.]

Make These Changes in Your Copy of Directory Section

THE FOLLOWING changes should be made in the Directory Section published in the January 1953 issue of Heating, Piping & Air Conditioning:

Add under heading "Fans, Centrifugal" on page 25d:
Hartzell Propeller Fan Co., Piqua, Ohio.

Add under heading "Insulation, Pipe" on page 44d:
Glass Fibers, Inc., Toledo, Ohio.

Add under heading "Louvers and Shutters, Automatically or Manually Controlled" on page 45d:
Muckle Mfg. Co., Owatonna, Minn.

Add under heading "Radiation, Baseboard, Non-Ferrous" on page 59d:
Tuttle & Bailey, Inc., New Britain, Conn.

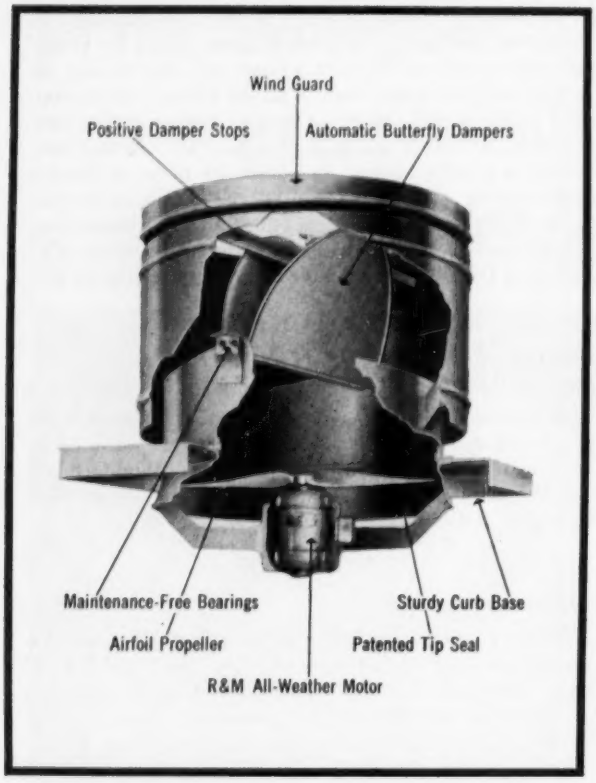
Add under heading "Softeners, Water" on page 69d:
Bruner Corp., Milwaukee, Wis.

Add in address section, on page 119d:
Bruner Corp., 2318 N. 30th St., Milwaukee, Wis.

Add in address section on page 132d:
Universal Industrial Propeller Co., Stamford, Conn.

SKY-BLAST®

The Modern Power Roof Ventilator



Most economical way to expel heat, fumes, smoke

This modern power roof ventilator is backed by 20 years of research and engineering.

Famed airfoil propeller, powered by the *All-Weather* Robbins & Myers motor, sweeps up heat, moisture, dust, fumes—then *blasts them high into the outside air.* Wind guard and throat design assure constant performance regardless of wind.

Automatic butterfly dampers open wide on minimum fan pressure for guide vane effect and virtually unrestricted air flow. Galvanized roof over damper shaft and bearing supports provides rainshed when fan is not operating. Easily mounted on any type roof, Sky-Blast provides air deliveries up to 78,800 CFM. Low silhouette cuts down roof stresses. Our engineers will be glad to give you free advice on any ventilating problem.

Write for Catalog 680-H.

PROPELLAIR®
DIVISION OF ROBBINS & MYERS, INC.
SPRINGFIELD · OHIO

Man Cooler | Direct Drive | Tubeaxial | Vaneaxial | Extended Shaft

WE HEAR THAT . . .

TRION, INC., manufacturers of electronic air-cleaning equipment, has passed the $1 million mark in sales in 1952, doubling its previous year's dollar volume, according to *PRES. E. W. MEYERS.* This is the fourth time the firm has doubled its orders in the six years it has been in business. Mr. Meyers predicted it will repeat in 1953 with a better than $2 million volume.

Plans for the expansion of the sales organization of the *O. A. SUTTON CORP.* were announced recently by *A. RISING,* vice president and sales manager. The new plans provide for the placement of factory trained sales representatives in a number of sales districts throughout the nation. The representatives will work directly under the district sales managers and will assist in dealer sales training programs.

CORY CORP. has announced that the first production of "Fresh'nd Aire's" new 1953 line of air conditioners has begun at the company's new manufacturing plant at Grayslake, Ill. According to *J. W. ALSDORF,* the company had orders for more than 50 percent of 1953's anticipated production by the end of 1952.

The South's first plant for the manufacture of welding electrodes and brazing alloys will be built by *WESTINGHOUSE ELECTRIC CORP.* near Montevallo, 38 miles south of Birmingham, Ala. Plans call for a one-story steel and brick structure to be erected on a 52-acre site. In addition to welding electrodes for normal industrial use, it will be equipped to produce some of the newest and latest types of electrodes that are being developed for Armed Forces requirements. Construction will begin this month and completion is scheduled for September.

A million-dollar musical show, "unprecedented in the introduction of industrial products," went on the road last month to show *SERVEL's* 1953 line of appliances to dealers coast to coast. *W. PAUL JONES,* president, said that two road companies will take the "1953 Show of Stars" to 30 cities. Simultaneous premieres were held in New York and Boston. The five-hour musical production was assembled by a Broadway producer and both troupes total more than 100 persons. Tickets are limited to company distributors, dealers and utility representatives.

One of the largest blast furnace turbo-blowers ever built in this country was opened for inspection to steel mill and engineering company representatives at the *DE LAVAL STEAM TURBINE CO.* plant where the unit was built. The giant blower, which is one of a pair manufactured for the Armco Steel Corp., is a 5-stage unit with a rated capacity to deliver 121,000 cfm of air at 35 lb psig discharge pressure. It will be driven by a 15,220 hp-2500 rpm De Laval 16-stage steam turbine under operating steam conditions of 400 lb psi, 750 F with 28 in. vac. Total weight of the turbine and blower is over

Taking the Stains and Strains out of DUPLICATING

Duplicating letters was a messy, tedious job in the '90's. If a girl was extremely efficient, she could turn out *five* copies per minute.

How different today—motor driven machines, featuring automatic inking and feeding, make *180 copies per minute* with ease!

Dramatic progress, such as this, has followed the motorizing of equipment used in business, in industry, in the home, and on the farm, too.

Throughout our 63-year history Emerson-Electric has been called upon by many of the nation's leading manufacturers to design and produce dependable, efficient motors for their applications.

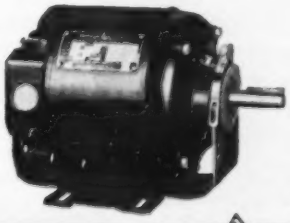
Get detailed information on how Emerson-Electric motors, in ratings from 1/20 h.p. to 5 h.p., can add new sales appeal to your product. **Write...THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.**

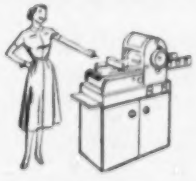
MODERN BUSINESS IS POWERED WITH ELECTRIC MOTORS

Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M176-A Capacitor-Start
- ☐ M176-B Split-Phase
- ☐ M176-C Integral
- ☐ M176-D Fan-Duty
- ☐ M176-E Oil-Burner
- ☐ M176-F Jet Pump
- ☐ M176-G Blower





A. B. Dick Co., builder of modern Mimeographing equipment is a user of Emerson-Electric motors.

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The Sensatherm is EXTREMELY SENSITIVE. The small mass in the construction and the little power required to open and close the circuit enables the Sensatherm to detect changes in temperature as soon as they occur, thereby maintaining the desired room temperature at all times.

The Mercoid Sensatherm requires no maintenance. It is equipped with the famous Mercoid magnet operated mercury switch which gives a million operations without deterioration. This switch is immune to dust, dirt or lint—no contacts to clean or stick.

The cover of the Sensatherm has a jewel hard alumilite finish that will harmonize with any scheme of interior decoration—it will last a lifetime.

Check the facts, and you too, will specify the Mercoid Sensatherm for your next job.

Manufacturers of Automatic Controls

For the HOME For INDUSTRY

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167 tons with the blower unit making up over 212,000 lb of this weight.

DRAVO CORP., for the fourth year in a row, will sponsor two cash awards to stimulate participation in the School Science Fair, scheduled for the two weeks of April 18-May 3 in Buhl Planetarium. The Fair, which is conducted jointly by the planetarium and The Pittsburgh Press, is open to students of junior and senior high schools in the Tri-State area. Projects for the contest are to be within the scope of any of Dravo's major divisions such as the machinery division which constructs power plants, installs air conditioning systems and markets space heaters and other industrial equipment.

New rules have been announced for the $2000 prize competition for "Contributions to the Science and Art of Non-Fusion Welding, Brazing and Soldering," by *EUTECTIC WELDING ALLOYS CORP.* The contest is open to engineers, metallurgists, research investigators, welders, students, faculty members and all others qualified.

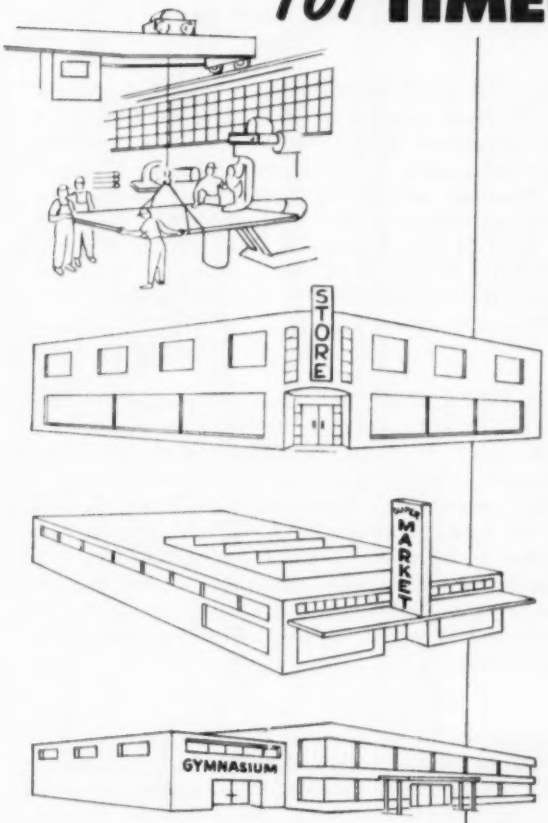
Up-to-date steam trapping for more production is the subject of a movie, "Please Pass the Condensate," prepared for the *YARNALL-WARING CO.* of Philadelphia. A 20-minute color and sound motion picture, it portrays the operation, selection, application and maintenance of steam traps. It is available for showing to engineering and plant groups.

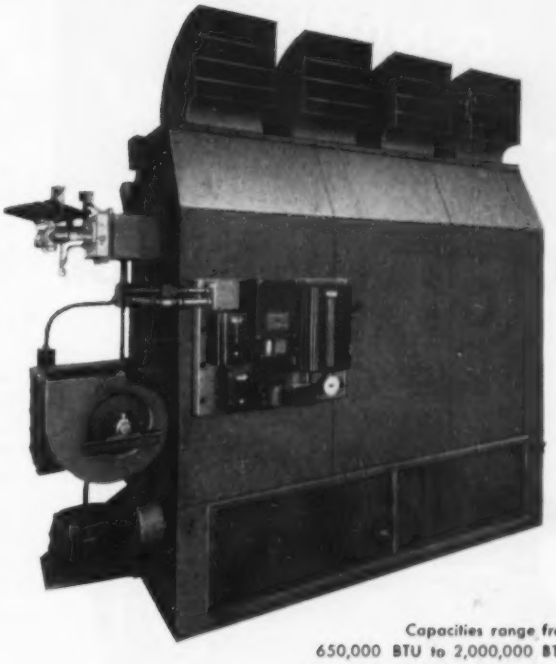
The Refrigeration Service Engineers Society is forming a *SERVICE MANAGER CLUB* for the top service executives of manufacturers of refrigeration and air-conditioning equipment, accessories and auxiliaries. An organization meeting was held in Miami several months ago when a temporary executive committee was appointed. Another meeting was scheduled for late January in Chicago to appoint a permanent committee, adopt by-laws and outline a program of activities and projects. The idea for the new club came from *PAUL B. REED*, international educational director for the refrigeration society.

The U. S. Machine Corp. of Lebanon, Ind. has become *DIVISION SIX OF STEWART-WARNER CORP.* in a transaction whereby 60,000 shares of Stewart-Warner stock has been exchanged for all assets of U.S. Machine. The shares of $5 par value capital stock will be distributed to U. S. Machine stockholders immediately. Present management and operating personnel of U.S. Machine will continue in their positions with *CARL J. WINKLER* as head of the division.

A new program to provide service on inoperative electric motors has been announced by *W. D. LEE* of the *GENERAL ELECTRIC SMALL AND MEDIUM MOTOR DEPT.* Called the Small Motor Service Station Plan, the program will provide a network of repair stations for G-E fractional horsepower and small integral horsepower motors. The service will include general repairing, fur-

Designed for **LONG** *Time Satisfaction for* **TIME-SAVING** *Installation*





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Easily installed — simply connect fuel, power and vent stack.

Fuel may be either gas or oil, or combination gas and oil. This combination burner for light oil and natural or manufactured gas provides *instantaneous change-over from one fuel to the other.* This change-over can be made manually with a switch or automatically with an outside thermostat.

Air to be heated can be either recirculated, drawn in from the outside or a combination of both providing tempered make-up to balance exhaust systems.

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Compact unit can be placed wherever it is needed, floor mounted or suspended. Tested safety and operating controls assure reliable, automatic operation.

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...without water!

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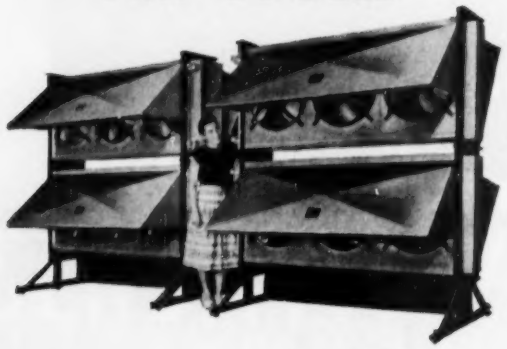

40 TON

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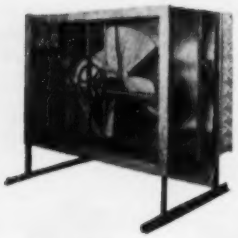
UNICON*

by KRAMER



Eliminates all water problems . . . because you don't use water with UNICON! Stands, hoods and wind deflectors are available for simplified outside mounting.

20 TON

WRITE FOR BULLETIN U-210

*Patent Pending

KRAMER TRENTON CO.
Trenton 5, N.J.

nishing renewal parts and exchanging motors for those that are inoperative. Present plans call for the authorization and franchising of up to 180 repair stations throughout the country. Each service station also will be offered a franchise as a distributor for the company's single-phase motors and motor renewal parts.

A franchise to sell Westinghouse air conditioning equipment has been awarded to *WARREN, LITTLE AND LUND* of Spokane, Wash. The firm serves a three-state area including parts of Washington, Idaho and Montana. Other franchises awarded by Westinghouse for their air conditioning equipment are: *THE MODERN HEATING AND SUPPLY CO.*, Portsmouth, Ohio; *TRI-STATE ENGINEERING AND SALES, INC.*, Salesbury, Md., and *GEIGER AIR CONDITIONING AND REFRIGERATION CO., INC.* of Irvington, N.J.

A. O. SMITH CORP. has begun construction of a new electrode plant at Lancaster, Pa. with completion scheduled for late July. The single-story plant on a 10-acre site will contain 41,000 sq ft of floor space, according to *L. T. HICKEY*, manager of the company's welding division. Space has been allowed for two complete production lines beginning at the mixing room and progressing through the packaging and shipping operations. Special features of the new plant include the use of extrusion presses and furnaces and strict humidity control of the coating and storage rooms.

Combination of all activated carbon, solvent recovery and air purification operations into one organization known as *BARNEBEY-CHENEY CO.* has been announced by *DR. O. L. BARNEBEY*, president. The new firm represents a merger of the Barnebey-Cheney Engineering Co. and the American Solvent Recovery Corp. The Pur Air Div. of the former American Solvent Recovery Corp. will continue as an operating division of the new firm. Other operating divisions will be the Adsorbite Div. and the Solvent Recovery Div.

AIR REDUCTION SALES CO. soon will begin construction of a new liquid oxygen plant in Riverton, N.J., according to an announcement by *H. R. SALISBURY*, president. The new plant, which is scheduled to begin production next year, will primarily serve the Delaware River Basin industrial area. In addition to oxygen, the plant will also produce nitrogen and argon. In full production, the plant will employ approximately 100 persons.

Commemorating the golden anniversary of air conditioning, as developed in 1902 by Dr. Willis H. Carrier, a plaque citing *THOMAS A. EDISON, INC.*, as a pioneer in the use of air conditioning for industrial purposes, was presented to *GEORGE E. STRINGFELLOW*, vice president and director of the Edison Co., by *HERBERT PEACOCK*, head of *CARRIER CORP.'s* eastern sales division. The Edison Co. began using the equipment in their film and phonograph record laboratories in 1911.

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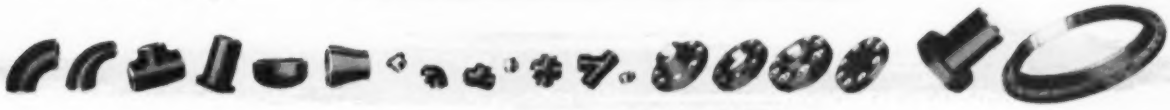

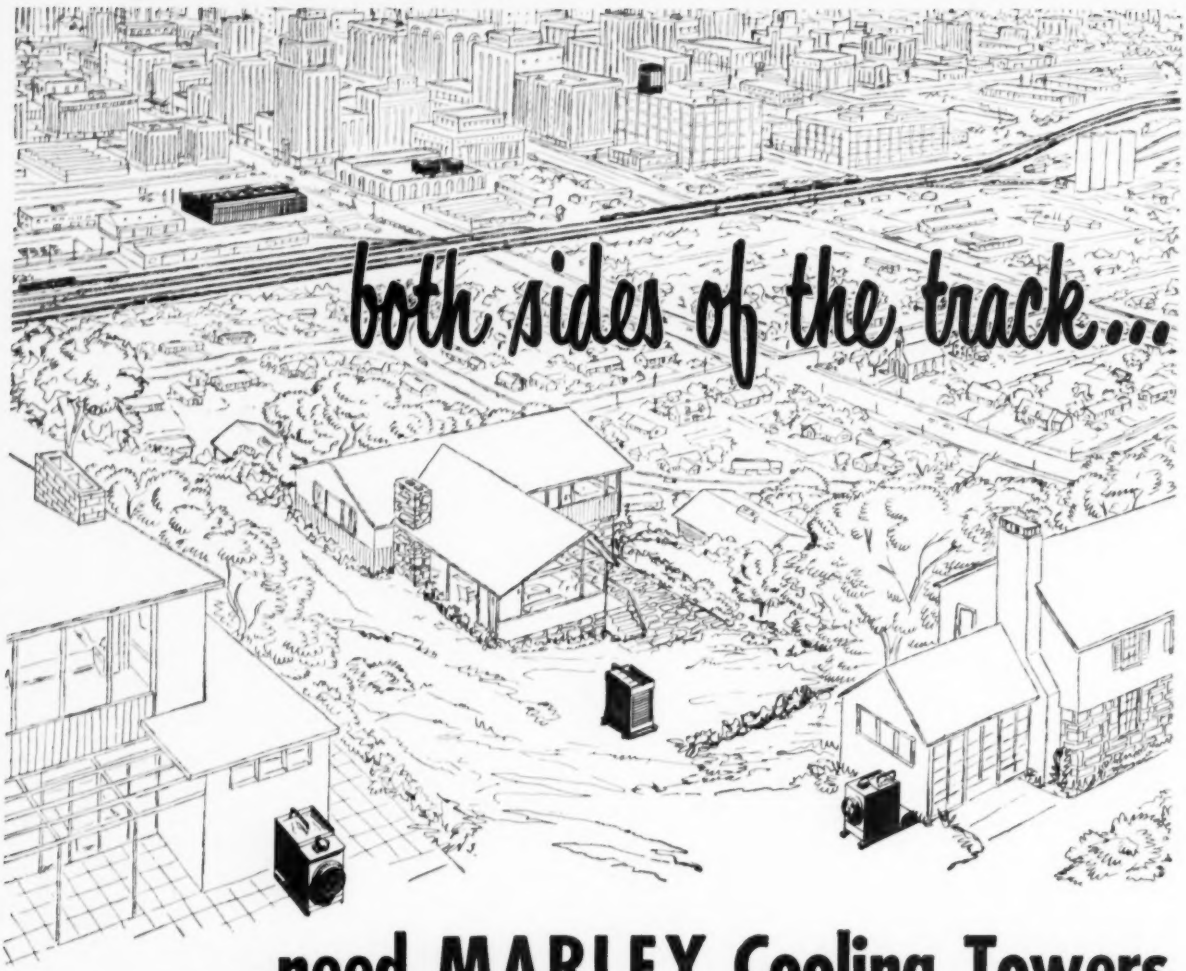

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Marley Aquatower, world's most popular mechanical draft cooling tower for residence air conditioning.

Everyone who sells or installs cooling towers is aware of the market for commercial and industrial towers and of Marley's dominance in the field.

Not so obvious but equally important is the rapid growth of a new market for Marley cooling towers over on the residential side of the tracks. Recent developments in home air conditioning have given this market a tremendous impetus. Thousands of Marley cooling towers have been installed in residential areas — and of greater interest to you are the multiplied thousands of Marley towers that will be installed in the coming season.

Now's the time to lay plans to capture your share of this sky-rocketing market. Make a survey of the potential in your city, and analyze the various small towers available. You'll find that "backyard business" has become *big* business — and that Marley offers the line that is most complete, easiest to sell and install, surest to satisfy your customers.

MARLEY

The Marley Company

Kansas City 5, Missouri

WHO'S WHAT

DONALD R. MECKSTROTH and *ROBERT B. ROBINSON* have been appointed to new positions in the sales division of *SERVEL, INC.* Mr. Meckstroth, formerly director of marketing services, now is manager of sales operations. Succeeding him is Mr. Robinson, who had been sales research manager.

RICHARD E. BALLENTINE has been appointed plant manager of the new welding electrode plant being constructed at Montevallo, Ala. by the *WESTINGHOUSE ELECTRIC CORP.* Until completion of the new plant, which is expected in September 1953, Mr. Ballentine will continue in his present position as development engineer on brazing alloys for the Motor & Control Div. He has been with the firm since 1940.

A new executive committee comprised of nine officers and directors of the *AMERICAN GAS ASSOCIATION* has been appointed. Members of the committee for the year are: *FRANK C. SMITH*, president, Houston Natural Gas Corp. and president of AGA; *EARL H. EACKER*, president, Boston Consolidated Gas Co., and vice-president, AGA; *F. M. BANKS*, president, Southern California Gas Co., and vice president, AGA; *EDWARD F. BARRETT*, president, Long Island Lighting Co., and treasurer, AGA; *CHARLES E. BENNETT*, president, The Manufacturers Light & Heat Co., Pittsburgh; *LYLE C. HARVEY*, president, Affiliated Gas Equipment, Inc., Cleveland; *J. F. MERRIAM*, president, Northern Natural Gas Co., Omaha; *DEAN H. MITCHELL*, president, Northern Indiana Public Service Co., Hammond; and *J. THEODORE WOLFE*, executive vice president, Consolidated Gas Electric Light and Power Co. of Baltimore.

After 20 years as manager of the Insulation Div. of the Ruberoid Co., *J. M. HIGH* has joined the *MUNDET CORK CORP.* as sales manager of the Insulation Dept.

WILLIAM B. COTT has been named manager of air conditioning application engineering for the Sturtevant Div., *WESTINGHOUSE ELECTRIC CORP.* Mr. Cott, who has been with the company since 1941, fills a post left vacant by the death of Tolbert Earl Smith.

Several major changes in executive and administrative personnel have been announced by *THE DETROIT EDISON CO.* On December 1, 1952, *PAUL W. THOMPSON*, vice president in charge of engineering, construction and operations, was named executive vice president. This promotion climaxed a career which began in 1913 and ended with his retirement on January 1, 1953. Succeed-

this TRANSITE* Industrial Vent Pipe is good for many years more!

This 80-foot Transite stack vents corrosive gases from a trunk sewer in a large city. In excellent condition after 14 years, it has already outlasted the original metal breechings.

Typical of the long service life you can expect from Transite Pipe in solving tough venting problems, this durable asbestos-cement product successfully resists a wide variety of corrosive industrial fumes and gases and vapors which seriously affect other pipe materials in a short time.

Because Transite Industrial Vent Pipe is non-metallic and is therefore rustproof, it requires no paint or other protective treatment. Due to its unusually high chemical stability, it has substantially reduced replacement and maintenance costs in duct, vent and stack systems in plants across the country.

It is light in weight, easy to handle, easy to install, can be cut and drilled with ordinary tools. It comes in a complete range of sizes up to 36" in diameter . . . with a full line of rustproof, corrosion-resistant Transite fittings which make it adaptable to practically any job requirement.

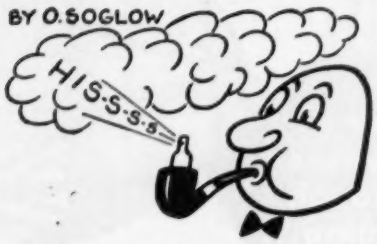
For further details on Transite for industrial venting, write to Johns-Manville, Box 60, New York 16, N. Y. Ask for Data Sheet Series DS-336. In Canada: 199 Bay Street, Toronto 1, Ontario.

*Transite is a registered Johns-Manville trade mark

Johns-Manville TRANSITE Industrial Vent PIPE

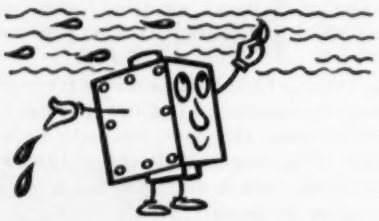
AIR-MAZING FACTS

BY O. SOGLOW



WHY SMOKERS GET STEAMED UP. If you like to smoke a pipe, you might enjoy a few puffs on your kitchen tea kettle, too. It's been found that about 70% of the so-called "smoke" from a pipe is actually steam.

ELIMINATES DUST ELECTRONICALLY! Electromaze electronic air filters "electrocute" dust, pollen—and even smoke particles. New "file drawer" design makes Electromaze lighter, stronger, easier to service. Users report prefabricated holding frames cut installation costs in half!



SORTS OIL FROM AIR! To keep troublesome oil out of crankcase ventilation systems, most internal combustion engine manufacturers use Air-Maze oil separators. Oil droplets are removed from the air stream, collected, and returned to crankcase. Available to engine builders in open-to-atmosphere types and in-line or closed circuit types.

WHETHER YOU BUILD OR USE engines, compressors, air-conditioning and ventilating equipment, *or any device using air or liquids,* the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

ing him as executive vice president is *ARTHUR S. ALBRIGHT,* vice president and treasurer. *GEORGE A. PORTER,* manager of construction, has been named to succeed Mr. Thompson as vice president in charge of engineering, construction and operations. Another appointment announced by the company is that of *DONALD F. KIGAR* as manager of construction. He has been with the company since 1926.

J. R. ALEXANDER is the new general sales manager for the *QUAKER RUBBER CORP.,* Div. of H. K. Porter Co., Inc. Mr. Alexander, who has been with Quaker since 1944, will be in charge of the company's sales activities. He came to the company as a sales representative and has been successively city sales manager and district sales manager. He also was instrumental in establishing the Detroit sales office and warehouse of which he became district manager.

HAROLD BURNIP has been appointed director of purchases by the *LINCOLN ELECTRIC CO.* Mr. Burnip, now responsible for all purchasing, had been director of purchase engineering. Previous director of purchases was *J. S. ROSCOE,* who recently was named executive vice president in charge of business administration. New director of purchase engineering is *NORMAN ZOLLAR. ARTHUR WALPER* will take over the duties of manager of electrode division purchases.

PAUL W. GROVER has been appointed manager of advertising and sales promotion for the air conditioner department, RCA Victor Div., *RADIO CORP. OF AMERICA.* He replaces *E. B. CLOSE,* who resigned to join Patterson Productions. Mr. Grover had been with the T. A. O'Laughlin Co.

A. R. FISHER has been elected to the board of trustees of the *INDUSTRIAL HYGIENE FOUNDATION.* Mr. Fisher is president of Johns-Manville Corp. and has long been active in the promotion of industrial health among workers. New members appointed to the foundation's legal committee are *E. C. STARKEY,* office of general counsel, Ford Motor Co., and *CLARENCE G. JOHNSON,* regional claims manager, Employers Mutual Liability Insurance Co. of Wisconsin.

ROBERT GUELCHER now is an industrial engineer for the *AJAX FLEXIBLE COUPLING CO., INC.* He was formerly assistant works manager of Uniflow Mfg. Co.

STANLEY J. NELSON, for the last year assistant general superintendent of *MINNEAPOLIS-HONEYWELL REGULATOR CO.,* has been promoted to factory manager in a series of production organization changes. *JACK G. GENTRY,* who since last year has been superintendent of the company's thermostat assembly plant, has been named

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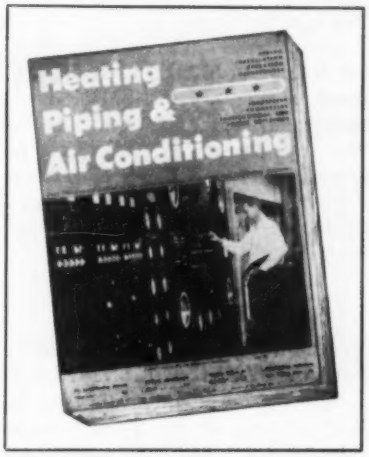
FOR PRACTICAL DATA TO HELP SOLVE YOUR PROBLEMS IN

HEATING, PIPING & AIR CONDITIONING



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196 pages, $1.50

• INDUSTRIAL AIR CONDITIONING HANDBOOK

Information on the purpose, cost, design, operation and maintenance of both process and comfort air conditioning systems in manufacturing plants of many kinds. The combined knowledge and experiences of 33 prominent engineers, every one a designer or in direct charge of the largest factory air conditioning systems in operation. This shows other engineers how air conditioning helps speed production, improve products, and increase worker efficiency . . . how to operate systems economically.
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Complete information on correct design, installation and operation of snow melting systems is offered in this reprint of articles originally published in "Heating, Piping and Air Conditioning." Design data based on a study of—and others' actual experience with—over 100 snow melting systems of all kinds. Applications illustrated, for loading platforms and docks; sidewalks; roads; driveways; marquees; parking areas; runways; railway switches, etc., prove that this method costs no more than other methods.
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By William Goodman . . . A timely and practical discussion of basic principles that govern design and control. Explains methods of accomplishing certain desired results in systems.
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• INDUSTRIAL VENTILATION HANDBOOK

A practical manual on fume removal, dust collecting, ventilating and exhaust systems for industrial plants. Tells how to design correctly and provide for various ventilation requirements . . . make measurements and analyses of fumes, mists and dusts . . . plan exhaust systems, etc. Twenty eminent authorities contributed also to detailed descriptions of systems in actual operation in many plants, whatever the manufacturing process.
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...ideal for radiator-heated homes

Mueller Climatrol solves the problem of how to cool radiator or radiant-heated homes with the new Mueller Climatrol 904. A self-contained cooling unit complete with blower — the 904 has provisions for duct connections that make it ideal for radiator or radiant-heated home cooling applications. It is also available with return and discharge grilles as shown. Trim, compact, highly efficient — there's a size to handle most of your customers' needs — 2, 3, 5, 7½ tons.

Commercial Units, too

This same unit hits the nail on the head for commercial use in small groceries, barber shops, drug stores, apparel shops, florists, restaurants, etc. Finished in handsome gunmetal gray—the 904 adds beauty to interiors wherever it is installed.

Built to Mueller's 96-year standard of high quality —the 904 gives you the dependable service that means greater customer satisfaction. Be sure to investigate the 904 — it's the latest product from the Big Name in Heating *and Cooling*.

L. J. MUELLER FURNACE CO.

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96th Anniversary

Mueller Climatrol

D-139

This is only one of many new items in the 1953 Mueller Line. Write for the latest information on the new Mueller Climatrol 904 Self-Contained Cooling Unit.

to succeed Mr. Nelson as assistant general superintendent. Other changes include *ERNEST BUFFINGTON's* promotion to superintendent of assembly and the promotion of *RAYMOND FRIES* to superintendent of manufacturing.

WILLIAM E. JUDD, general sales manager of the South Wind heating equipment division of *STEWART-WARNER CORP.*, has been appointed assistant to James S. Knowlson, president and board chairman. His appointment fills the vacancy created by the appointment of *LEONARD L. ROBB* as head of wholesale sales of Alemite lubrication equipment and Stewart-Warner instruments several months ago. *WILLIAM V. RYAN* succeeds Mr. Judd as general sales manager of the South Wind Div.

R. M. MARBERRY has been promoted to the position of national sales manager of the *TIMKEN SILENT AUTOMATIC PRODUCTS* — Timken Silent Automatic Div. He has been merchandising manager of the division since 1951. Prior to this, Mr. Marberry had been advertising manager of the parent Timken-Detroit Axle Co.

D. T. MARVEL has been appointed vice president for sales of *OLIN INDUSTRIES, INC.* He will have responsibility for the company's overall sales, advertising and sales promotion, and marketing activities of the operating divisions administered by F. S. Elfred, executive vice president. These are the arms and ammunition, metals, explosives, electrical, Ramset and export divisions.

VAPOR HEATING CORP. has announced the appointment of *WILLIAM C. KEERAN* as executive engineer. In his new position, Mr. Keeran will supervise all phases of engineering, research and design of the company's products. Mr. Keeran also will continue as vice president in charge of Roth Mfg. Co., a manufacturing subsidiary of the corporation.

J. F. KNOFF has been named vice president and general sales manager of the *CHRYSLER AIRTEMP DIV.* Mr. Knoff, who has been with the company for nearly eight years, has served as general sales manager of the Airtemp Div. since 1951. Another appointment announced by the company is that of *R. F. BERTRAM* as general auditor.

G. E. DeBORD, president of the newly formed *EVIS-NORTHEAST CO.* of Albany, N.Y., has announced the appointment of *FRED F. RICHARDS* as general sales manager.

On January 1, the engineering division of the *GULF RESEARCH & DEVELOPMENT CO.*, the research organi-

Here's the way to plug costly water waste!

WITH HM

COOLING TOWERS

20-Year Guarantee!

ON THE WETTED DECK SURFACE

Here's the economy way to water savings—20 years of foolproof performance in an all-around, efficient, economical and lastworthy cooling tower. The processed wetted deck surface in these quality Halstead & Mitchell cooling towers is chemically treated with special Koppers wood—guaranteed 20 years against rotting, and proofed against fungi growth. Gravity-type distributing pan eliminates extra pumping head required on spray-type towers, and cuts down windage losses due to atomizing of water. And, it's easily cleaned—accessible through inlet air side of tower.

BATTLESHIP STRENGTH!

HOUSING—
Of heavy 10 gauge (1/8"+) sheet steel, with three coats of Bitumastic lining, and four coats of outside special weatherproof paint. Electrically welded cabinet.

FAN & DRIVE—
Quiet hi-pressure 8-bladed Stainless Steel fan, stainless steel shaft, chrome-dipped rust-proofed pulleys, ball-bearing grease-sealed fan bearings.

Capacity range: 2 to 100 tons.

CARRIED IN STOCK BY LEADING WHOLESALERS EVERYWHERE

Send for Literature and Prices

HM *Halstead & Mitchell*

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.

Five of the Clarage Heavy Duty Fans in the air conditioning systems of The Upjohn Company's new plant in Kalamazoo. Korfund Twin Rail Fan and Motor bases were used to prevent vibration and noise transmission into the supporting steel deck and the duct work.

...by installing over 200 fans and motors on Duplex bases

Upjohn has long been known for extreme care in the production of fine pharmaceuticals. Therefore, in building their new plant, quiet, spotless working conditions were a prime consideration. This called for 120 complete air conditioning systems with 324 Clarage Heavy Duty fans.

To conserve floor space, The Austin Company, Engineers and Builders planned the installation on suspended platforms and structural steel members under the roof.

Korfund Twin Rail Bases were specified so that no vibration or noise could reach the working areas through the steel decks or through the ducts, and to simplify the installation.

Complete adjustability of the Duplex Twin Rail separate bases for fan and motor made it easy to take care of variations in drive center distances, motor positions and other variables; and the exclusive built-in chocks in these bases guaranteed permanent alignment.

For installation of fans, pumps, compressors, refrigerating and other types of mechanical equipment for both normal and critical operating conditions, basic isolation recommendations are given in Korfund Bulletin G-104. See Sweet's Catalog Files, or write for your free copy today.

If you have a problem, we will be glad to submit recommendations without obligation. A half century of experience is at your disposal. Representatives in principal cities.

THE KORFUND COMPANY, INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

41-01F Thirty Second Place, Long Island City 1, N.Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

zation of Gulf Oil Corp., was divided into two new divisions: engineering and automotive engineering. *E. TOPANELIAN, JR.* has been appointed director of engineering, with *BRUCE R. WALSH* as assistant director of engineering.

Several changes in personnel have been announced by the *O. A. SUTTON CORP. HOWARD K. BENTZ* has been appointed vice president and manufacturing manager. Named as new national service manager is *RAY THOMPSON,* who formerly was district sales manager of the Chicago area. *DAN J. MULL,* formerly assistant chief engineer of the firm, now is chief engineer. Mr. Mull will be responsible for the engineering and designs of all domestic products. Appointed as the first field sales and service engineer for the corporation is *RUSSELL E. BOGARDUS.*

CHARLES E. GLENNON has been appointed sales engineer for the Platecoil Div. of the *KOLD-HOLD MFG. CO.* He had been chief of the industrial division and production engineer for the Chicago Chemical Procurement District of the U.S. Army.

R. RANDALL IRWIN has been appointed manager of personnel and industrial relations for the Brown Instruments Div. of *MINNEAPOLIS-HONEYWELL REGULATOR CO.* He will be responsible for the coordination and guidance of various personnel functions and also for the formulation of the firm's industrial relations policies.

JOHN E. MADDEN has been named president and *WILLIAM E. CLOW, JR.,* chairman of the board, of *JAMES B. CLOW & SONS.* Mr. Madden, who has been with the company since 1921, succeeds the late Kent S. Clow. The company also has announced the appointment of *G. R. KINNALLY* as general manager of the jobbing division.

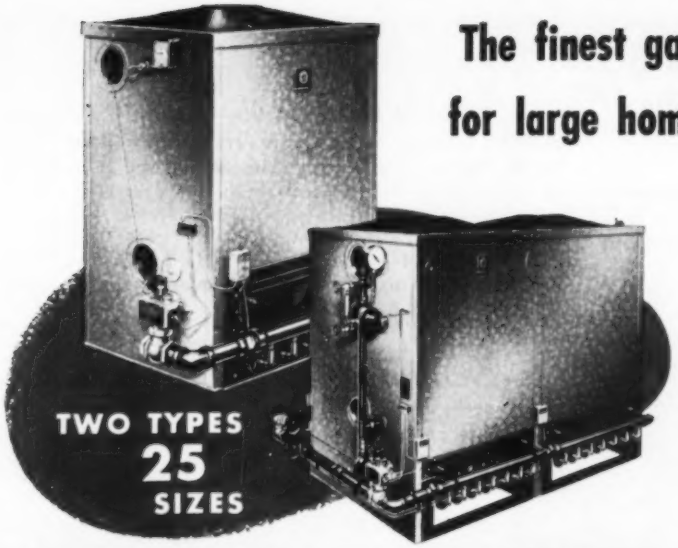
ARNOLD I. THORSEN, works manager, *ALLIS-CHALMERS MFG. CO.* Norwood Works, has been appointed assistant director of manufacturing of the company's general machinery division in Milwaukee. Mr. Thorsen, who has been at the Norwood Works since 1940, joined the company in 1926. *J. F. COSTIGAN,* assistant works manager at Norwood, has been named the new manager.

TED NEMES has been named sales manager of the newly created air conditioning div. of the *ADMIRAL CORP.*

HAROLD P. HANSEN is the new general sales manager of the *DOLE REFRIGERATING CO.* in Chicago. *JACK E. HUTCHINSON* has been appointed manager of the Canadian subsidiary in Brantford, Ont., and *RAY E. KEMPF* is Canadian sales representative.

CHARLES W. KNOWLES has been appointed senior vice president of *WALTER KIDDE CONSTRUCTORS,*

The finest gas boilers on the market for large homes and larger buildings!

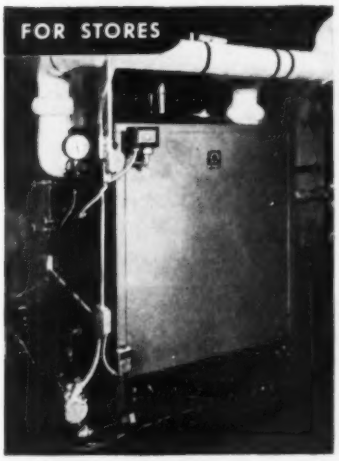


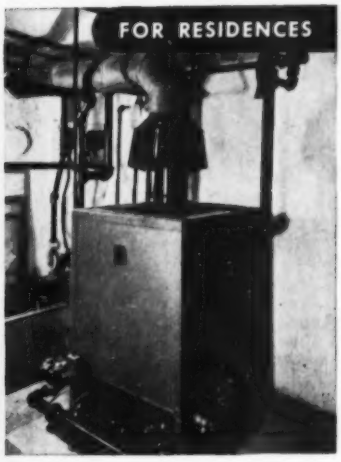
STANDARD BOILERS
by AMERICAN-Standard

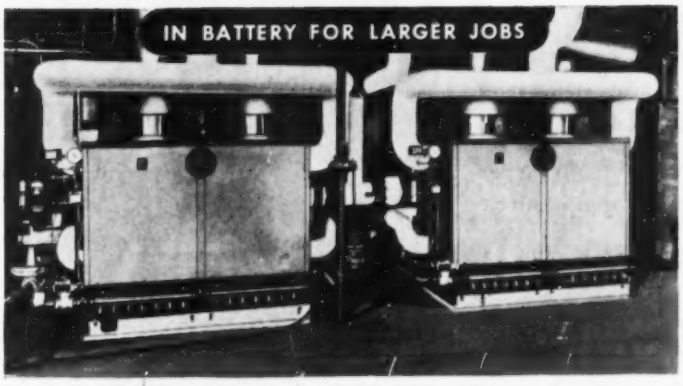
● Designed by experts in the field of gas heating, Standard boilers are outstanding examples of good engineering and manufacturing skill. Heating surfaces, burners, controls and other essential features are coordinated to assure maximum heat output with lowest operating and maintenance cost.

Made in two types—1-G and 4-G—and in twenty-five sizes, these top quality boilers provide effortless gas heating in large homes, apartment buildings, hospitals, and in various commercial and industrial buildings. Furthermore, they can be used in batteries in larger buildings to provide an extremely flexible heat source through the operation of one or more units, thus giving added economy in mild weather, as well as perfect comfort in the coldest weather.

For detailed information about Standard gas boilers, contact your wholesale distributor. **American Radiator & Standard Sanitary Corporation,** P.O. Box 1226, Pittsburgh 30, Pa.







Precision-machined and sub-assembled to facilitate quick and easy installation

Standard boilers have cast-iron sections which are precision-machined to facilitate quick and easy assembly. Individual sections may be conveniently carried through any ordinary doorway. To save further time and labor, controls, valves, and control piping are factory-assembled as far as possible.

NEW DATA BOOK Now Available!

A comprehensive, instructive manual to help you select and install any type of radiator heating equipment in the American-Standard line. Ask your wholesaler for your copy. Form No. 220.

AMERICAN-Standard
HEATING

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

INC., Mr. Knowles, formerly vice president and general superintendent, has been with the company for 27 years and succeeds *WALTER S. WAINWRIGHT*, who has retired. *HAROLD A. CARTIER*, formerly secretary, has been appointed vice president of the organization.

JACKSON KEMPER has been elected vice president of the *H. K. PORTER CO., INC.* He will continue in his present capacity as general manager of the Watson-Stillman Fittings Div. in Roselle, N.J.

IN THE TERRITORIES . . .

For *RIC-WIL CO.* and *WARREN WEBSTER & CO.*— Changes in representation in New York City and the immediate area. The Ric-Wil Co. has moved into a new office at 215 E. 37th St. *JOHN F. HANBURY*, former New York district representative for Webster and Ric-Wil now is manager of the new Ric-Wil office, with *CARL G. MENCKE* as assistant manager. Warren Webster and Co. will continue its office at 95 Madison Ave. with *KENNETH C. STEENECK* as the new district representative.

For *REVERE COPPER AND BRASS, INC.—OSCAR E. PETERSON* is the new district manager of the Indianapolis district sales office of the company's Dallas Div. in Chicago. Mr. Peterson had been with the sales department in the Chicago office for the past several years. In Indianapolis he succeeds *P. H. ANDERSON*, who has resigned.

For *WILLIAM WALLACE CO.—EARL FUSON* is the assistant manager of the Dallas, Texas, office of the Metalbestos Div. *C. E. BLOME*, manager, also will be in charge of the national training and promotion program.

For *FARR CO.—DONALD S. HARWORTH* is Southern Div. sales manager with headquarters in Nashville, Tenn.

For *CYCLOTHERM CORP.*, Div. of U.S. Radiator Corp. — A new Chicago office for sales in that area. *JOE DAVID* is head of the new office and chief consultant. The new offices are located at 131 Dearborn St.

For *MINE SAFETY APPLIANCES CO.* — New headquarters and warehouse facilities in Kansas City, Mo. to serve a new nine-state sales district. *C. H. MEHAFFEY* is sales manager of the district covering Kansas, Missouri, Iowa, Minnesota, Wyoming, eastern Montana and North and South Dakota.

For *RELIANCE ELECTRIC & ENGINEERING CO.* — *ANDREW C. PERRIN* is west coast district sales manager with headquarters in San Francisco. *KEITH E. CARTER*,

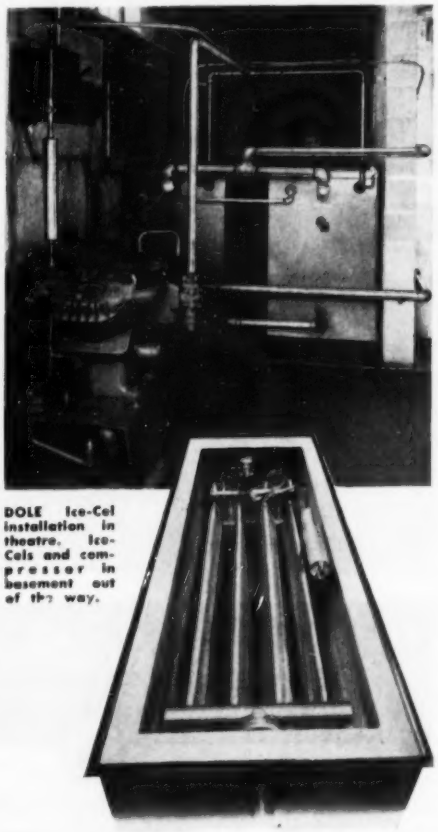
DOLE *Ice-Cels* . .

Economical, Efficient Comfort Cooling

DOLE Ice-Cels are ideal for comfort cooling of auditoriums, theatres, lodge halls, cafeterias, churches, mortuaries, offices and stores where peak loads are of short duration—a few hours a day. Because charging can be done in off-use hours, a smaller, less costly condensing unit can be employed thereby saving in original investment and in operating power costs.

DOLE Ice-Cels are available in three capacities for all types of comfort cooling installations.

Ask for Catalog F-2.



DOLE Ice-Cel installation in theatre. Ice-Cels and compressor in basement out of the way.

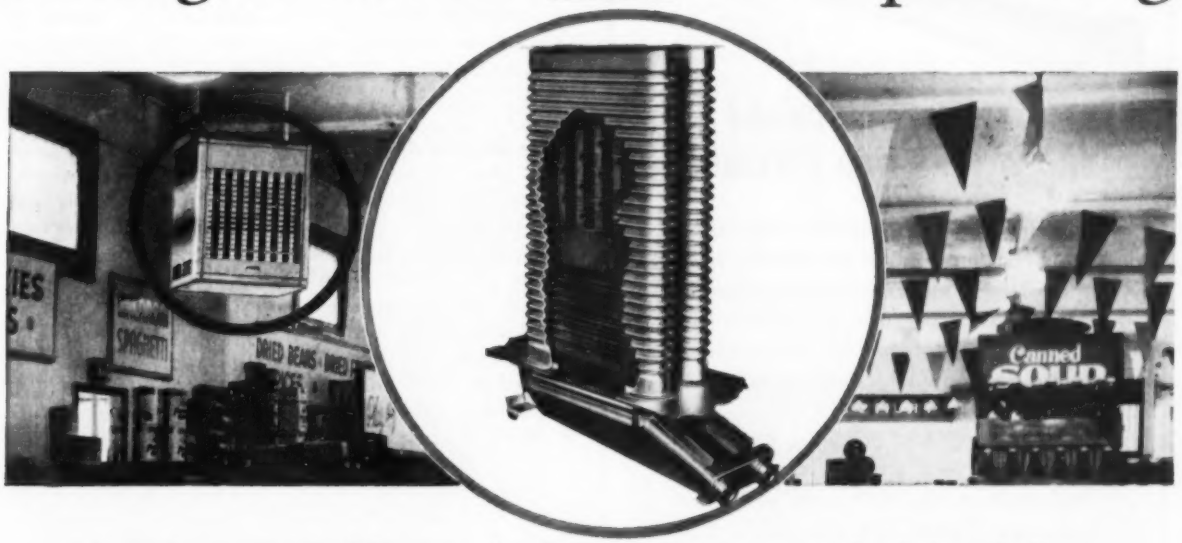
DOLE Vacuum COLD PLATES for REFRIGERATION PURPOSES

DOLE REFRIGERATING CO.

5910 N. PULASKI RD., CHICAGO 30, ILL.
103 Park Ave., New York 17

In Canada: Dole Refrigerating Products Limited, 44 Elgin Street, Brantford, Ontario.

In the year 2000...this ®Janitrol all-steel heat exchanger could *still* be operating



Here's remarkable proof of Janitrol's unmatched durability ...No other equipment is backed by this calculated performance.

After twelve years service, a Janitrol Steel Unit Heater was removed from a New Jersey delicatessen store and tested by one of the country's leading research institutes. By exacting, microscopic examination and measurement it was found that weight loss due to pitting and corrosion of the steel heat exchangers was *less than standard mill rolling tolerances allowed for this steel.*

While this unit used manufactured gas with a sulphur content averaging 10.5 grains, the maximum pit penetration rate varied from 0.04 to 1 mil per year indicating 48 years of life expectancy.

Therefore, heat exchangers of this Janitrol design, installed under similar circumstances could be expected to last beyond the year 2000.

It must be remembered that no other gas-fired unit heater has the unique Janitrol design of heat exchanger and burner combination principle that minimizes the possibility of corrosion and burn-outs... maintains even metal temperatures from the bottom to top of the heat exchangers.

So, these results cannot be obtained from ordinary "fire-box" design equipment with its problems of varied metal stresses and strains.

DURABILITY DEPENDS ON DESIGN NOT METAL THICKNESS ALONE!

Here then, is further evidence of Janitrol Complaint-Free Engineering, a result of tireless effort in research and development to provide better performance with lower maintenance costs.

THIS LITERATURE CAN BE HELPFUL IN MANY WAYS

The Commercial and Industrial Heating Guide, A.I.A. File 30, gives complete data on the application of gas-fired unit heaters to meet a wide variety of heating problems.

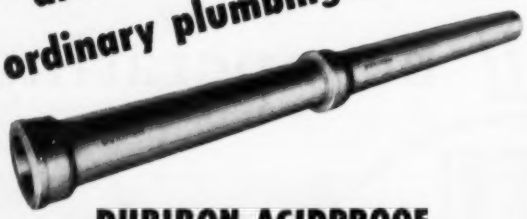
"Businessman's Blue Book of Better Heating" illustrates actual unit heater installations in many different types of buildings . . . you'll find both, useful reference material.

"The Janitrol Space-maker" booklet gives details on the remarkable life-tests and describes the new Janitrol Horizontal Gas Unit for commercial and residential installations.

WRITE FOR YOUR COPIES TODAY

SURFACE COMBUSTION CORPORATION • TOLEDO, OHIO

The permanent drain pipe installed by ordinary plumbing methods

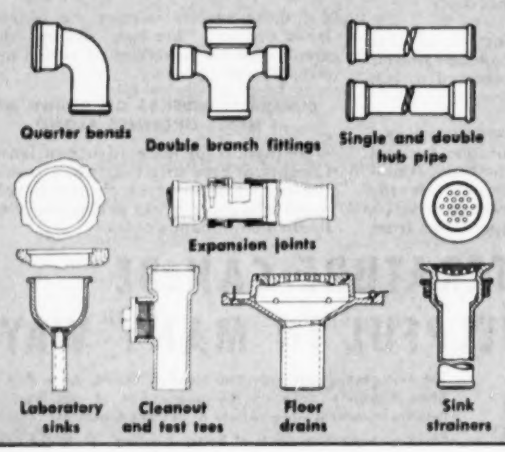


DURIRON ACIDPROOF DRAIN PIPE AND FITTINGS

Duriron is a high silicon iron alloy highly resistant to most commercial acids at practically all temperatures and concentrations. It is not a coating—the entire thickness of the pipe wall is resistant to abrasion and erosion as well as to corrosion.

The labor cost of installing Duriron is the same as with ordinary cast iron soil pipe. Normally the initial cost is the final cost since Duriron will generally outlast the building in which it is installed.

SOME OF THE MORE THAN 60 STANDARD DURIRON FITTINGS



AVAILABLE FROM STOCK IN PRINCIPAL CITIES

Write for Bulletin PF/1

THE DURIRON COMPANY, Inc.

402 North Findlay Street

DAYTON, OHIO

DURIRON

LOOK FOR THE NAME ON EVERY PIECE

sales engineer in Pittsburgh, has been transferred to the Chicago office to take over Mr. Perrin's former sales engineering duties. *J. EDWARD HOUSE, JR.* replaces Mr. Carter in Pittsburgh.

For *MCQUAY INC.* — *L. K. ALTMAN* of Atlanta, Ga. and *O. D. ALTMAN* of North Miami, Fla. are the new refrigeration products sales representatives in the southeastern territory.

For *PYLE-NATIONAL CO.* — *THE INDUSTRIAL EQUIPMENT CO.* is sales representative of the Multi-Vent Low Velocity Air Diffusion Panels Div. The territory consists of Kansas and the western half of Missouri.

For *DRYOMATIC CORP.* — Appointment of a New York State factory representative and three new distributors to serve the New York metropolitan area and outlying districts. *CLIFFORD d'A. HANNER* is serving as special factory representative in the New York metropolitan area. Distributors for New York City, Westchester County, nearby Connecticut and New Jersey, are *JOSEPH S. KERN, JR. & ASSOC., EQUIPMENT ENGINEERS.* Sales to industrial firms in Brooklyn and Queens are being handled by *EASTERN AIR CONDITIONING CO.*, Long Island City. Distributors on Long Island are *H. KLEIN & SONS* of Mineola.

For *PITTSBURGH LECTRODRYER CORP.* — *HARTZELL C. MILLS* is Minnesota representative with headquarters in St. Paul.

For *DETROIT CONTROLS CORP.* — *D. J. GOTT* is manager of the newly created western regional office in Los Angeles. Mr. Gott's previous post as representative in the San Francisco area will be filled by *E. C. WARD*, formerly of the Detroit sales office.

For *CRANE CO.* — Three personnel changes in the company's branches. Transferred are: *HAROLD U. CROPSEY* from Rockford, Ill. to the assistant managership of the San Antonio branch; *GEORGE M. ANDERSON* from Aurora, to the managership of the Rockford branch; *HENRY M. WHITE* from San Antonio to the assistant managership of the Denver branch.

For *SERVEL, INC.* — Two new regional managers. *BERT COLE*, former Philco and Crosley sales executive, is manager of the Eastern region with headquarters in New York City. *WILLIAM K. GRUBE*, former manager of Servel's Chicago operations, is manager of the Midwestern region with headquarters in Chicago.. Mr. Cole succeeds *GORDON J. MALONE*, who recently was named manager of home freezer sales. Mr. Grube succeeds *PAUL R. KENNEDY*, who has been placed in charge of the company's contacts with public utilities throughout the Southwest.

They SELL! They PLEASE!

AURORA

CLOSE-COUPLED

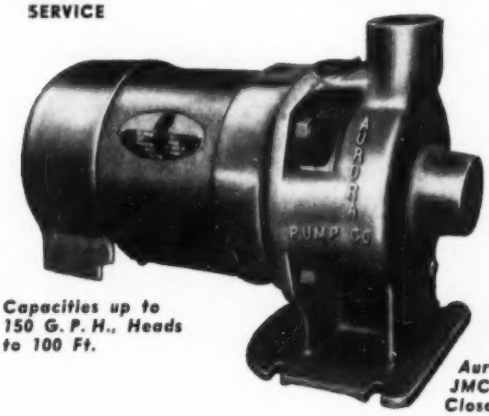
Packaged

AIR CONDITIONING PUMPS

for
EVAPORATOR COOLING TOWERS
•
AIR CONDITIONING UNITS
•
also for
GENERAL SERVICE

These are outstanding pumps, high in favor with air conditioning contractors and manufacturers of air conditioning equipment. Mechanical seal requires no packing or maintenance. Disassembly without disturbing pipe connections or hold down bolts.

- LOW COST
- LONG LIVED
- SMOOTH, QUIET
- MECHANICAL-SEAL
- DEPENDABLE
- DISASSEMBLY Is QUICK, SIMPLE
- CARRIED IN STOCK



Capacities up to 150 G. P. H., Heads to 100 Ft.

Aurora Type JMC Pump — Close-Coupled

CASINGS vertically split. Casing wearing ring standard.

MECHANICAL SEAL—standard, located in packing cover.

IMPELLER — balanced, enclosed type, high grade bronze.

MOTOR—NEMA specs., stainless steel shaft on JMC — for all circuits and various enclosures.

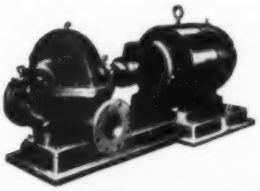
BALL BEARINGS — on JMC, built into motor.

OTHER AURORA AIR CONDITIONING UNITS

We are also in a position to supply various sizes of air conditioning pumps in V-Belt drive, and flexible coupling drive. Our large size type G.M.C. Close-Coupled Pumps can be furnished up to 800 G. P. M. and heads to 200 ft.

ALSO — AURORA SPLIT CASE CENTRIFUGAL PUMPS

— single and two stage for water supply, handling condenser circulating water, brine circulation, booster service and many other duties.



Complete Information on Request

DISTRIBUTORS IN PRINCIPAL CITIES

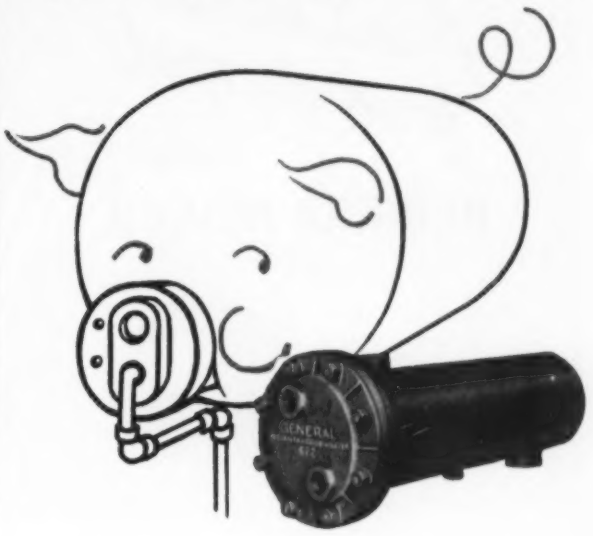
AURORA Always PUMPS

AURORA PUMP COMPANY

SUBSIDIARY OF THE NEW YORK AIR BRAKE CO.

80 Loucks Street — Aurora, Illinois

Replace Your "Floor-Hog"...



... with a modern water heating system

Install a compact GENERAL Instantaneous Heater

HERE'S A DEPENDABLE, continuous water heating unit you can install in a fraction of the space required by storage tanks of equal capacity. The largest of 20 GENERAL Instantaneous Heaters available measures only 21" x 84" . . . and delivers 300 g.p.m. of piping hot water! You can even install them overhead, completely out of the way.

They cost less, too . . . less to buy, install, and maintain. Just tap a General Instantaneous Heater into existing live or exhaust steam lines . . . no excavating, no complicated piping. Seamless copper tube, and bronze head and tube plate construction assure years and years of rust-free performance . . . a GENERAL Instantaneous will out-live all other water heating systems!

Whether you intend replacing your old water heating system, or expanding it, investigate all the advantages of GENERAL Instantaneous Heaters. Write, wire, or call for complete details. General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.

GENERAL

INSTANTANEOUS WATER HEATERS

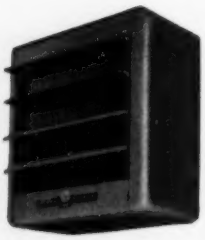
A unit heater for every need

from

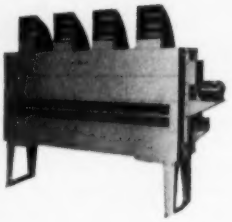
HERMAN NELSON

Vertical shaft propeller-fan type unit heater—*especially suited to buildings with high ceilings—up to 50 feet.*

Horizontal shaft propeller-fan type unit heater—*the most generally useful of all space heaters.*



Centrifugal-fan type unit heater—*for efficient heating and ventilating of large industrial spaces.*



De Luxe unit heater—*an attractive, quiet operating unit designed for stores, offices, churches, etc.*

Write for detailed information about any type Herman Nelson Unit Heater to: Dept. HP-2.

AAF

herman nelson

American Air Filter

COMPANY, INC.

215 Central Avenue, Louisville 8, Ky.

MEETINGS & CONVENTIONS

SECOND ANNUAL INDUSTRIAL VENTILATION CONFERENCE — February 16 to 19, Kellogg Center, Michigan State College, East Lansing. Sponsored by the School of Engineering and the Division of Industrial Health, Michigan Department of Health. Class room sessions, talks and demonstrations on practical application of exhaust systems for the control of industrial contaminants are scheduled.

NEW YORK SECTION OF THE INSTRUMENT SOCIETY OF AMERICA — Sixth annual regional meeting, February 18, Hotel Statler, New York. Technical program consists of sessions covering process instrumentation, power plant instrumentation and biological instrumentation.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2. — Conference and exhibition, March 16 to 20, Sherman Hotel, Chicago. Titles of six papers to be given are: "Use of All-Plastic Equipment and Piping in Technical Corrosion Protection;" "Corrosion by Acids at High Temperatures;" "Metallurgy of Corrosion;" "Statistical Analysis of Corrosion Data;" "Corrosion Study in a Salt Plant;" "The Behavior of Titanium in Sulfuric and Hydrochloric Acids."

EIGHTH OREGON STATE AIR CONDITIONING CONFERENCE — March 18-20, sponsored by the Oregon Chapter, ASHVE. The meeting is to be held in conjunction with the 1953 Northwest Heating and Air Conditioning Exposition at the Lincoln High School, Sixteenth and S.W. Salmon Streets, Portland. Chairman is Ed Lokey, 10304 N.E. Sandy, Portland 20.

PROTECTIVE COATINGS SYMPOSIUM, to be held during National Association of Corrosion Engineers Chicago conference, March 20 — One of the five papers to be presented at this session is, "Field Tests of Exterior Coatings for a Pipeline Conveying Fuel Oil Heated to 200 Degrees F," by E. R. Stauffacher and B. R. Davidson, which relates field tests and experience in selection of protective coatings for 41 miles of 8-in. schedule 30 pipe.

CONFERENCE ON FLUID MECHANICS — Third midwestern conference, March 23-25, University of Minnesota, Minneapolis. The subject matter will cover all features of theoretical and applied fluid mechanics.

NEW JERSEY SOCIETY OF PROFESSIONAL ENGINEERS, INC., 86 E. State St., Trenton — 29th annual convention and exhibition, April 17-18, Hotel Essex House, Newark.

OIL-HEAT INSTITUTE OF AMERICA, INC., 6 East 39th St., New York 16 — 31st annual convention, April 20-21, Edgewater Beach Hotel, Chicago.

. . . FROM HERMAN NELSON

IN the church shown above, 30 Herman Nelson De Luxe Unit Heaters maintain comfortable temperatures for all services. These versatile units are equally effective for heating stores, offices, markets, display rooms and similar buildings where compact, attractive, quiet-operating heating units are needed.

There are eight models of these unit heaters available for floor, wall, ceiling or recessed installation. All models have an improved "combination type" heating element suitable for either steam or hot water operation. The De Luxe Unit Heater cabinet contains modern styling obtained through superior designing. The absence of projecting parts and its rounded ends contribute to its graceful appearance. The unit is finished in satin-smooth, tan, baked enamel so that it enhances the setting in any application.

Herman Nelson Unit Heaters are ahead of the field because constant engineering development and research plus functional design have earned this position—the result of 45 years of experience in the production of heating and ventilation equipment.

ALUMINUM CENTRIFUGAL FAN WHEELS have slow tip speeds for quieter operation.

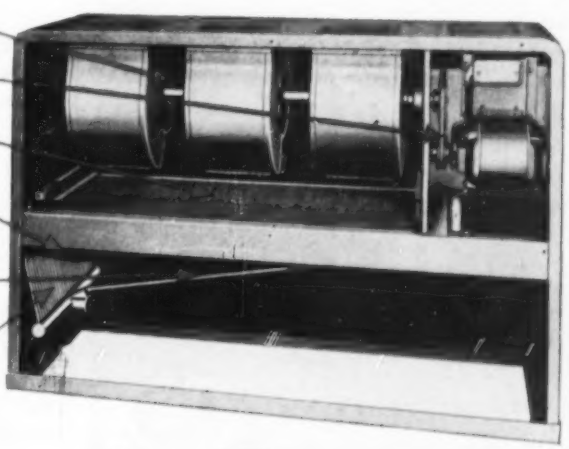
ADJUSTABLE PULLEY permits varying performance to meet exact requirements of job.

CONTINUOUS, NON-FERROUS FINS are formed with extra wide flange to provide efficient contact between expanded tubes and fins.

LOOP in each tube of heating element absorbs difference in expansion and contraction between individual tubes.

PATENTED, EXTRA HEAVY, RED BRASS STAY TUBE maintains proper relationship between headers without increasing strain on loops and allows entrained moisture to drain directly from supply to return header.

ENTIRE TUBE AND LOOP is fabricated of red brass with no connecting joint to weaken construction.



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COMPANY, INC.

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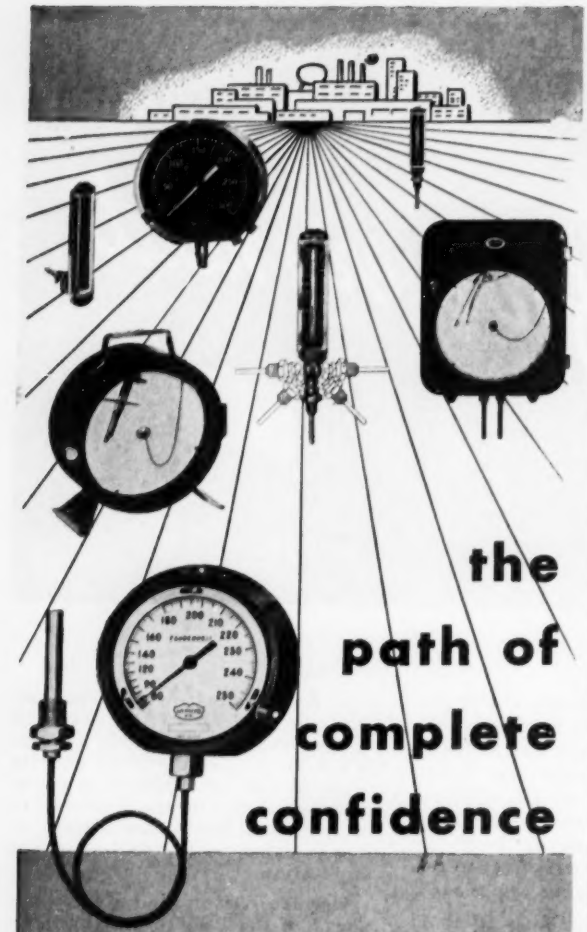

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AMERICAN ASSOCIATION OF SPECTROGRAPHERS, symposium on "Emission Spectroscopic Determination of Metals in Non-Metallic Samples," May 1, Chicago — Chairman is J. P. Pagliassotti, Standard Oil Co., Box 431, Whiting, Ind.

HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION — 64th annual convention, May 13-16, Edgewater Beach Hotel, Chicago. Secretary, Joseph C. Fitts, 1250 Avenue of the Americas, New York 20.

AIR POLLUTION CONTROL ASSOCIATION, 4400 Fifth Ave., Mellon Institute Building, Pittsburgh — Annual meeting, May 25 to 28, Lord Baltimore, Baltimore.

NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6. — 44th annual meeting, June 9 to 12, Lookout Mountain Hotel, Chattanooga, Tenn.

FOURTH NATIONAL STORE MODERNIZATION, BUILDING AND MAINTENANCE SHOW, Madison Square Garden, New York, June 9-12 — Sponsored by the Store Modernization Institute, it will cover physical properties and operation of retail stores including warehousing and distribution.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18. — National Spring Technical Meeting, June 16 to 19, 1953, Shamrock Hotel, Houston. Includes a four-day Welding and Allied Industry Exposition in the Shamrock Hall of Exhibits.

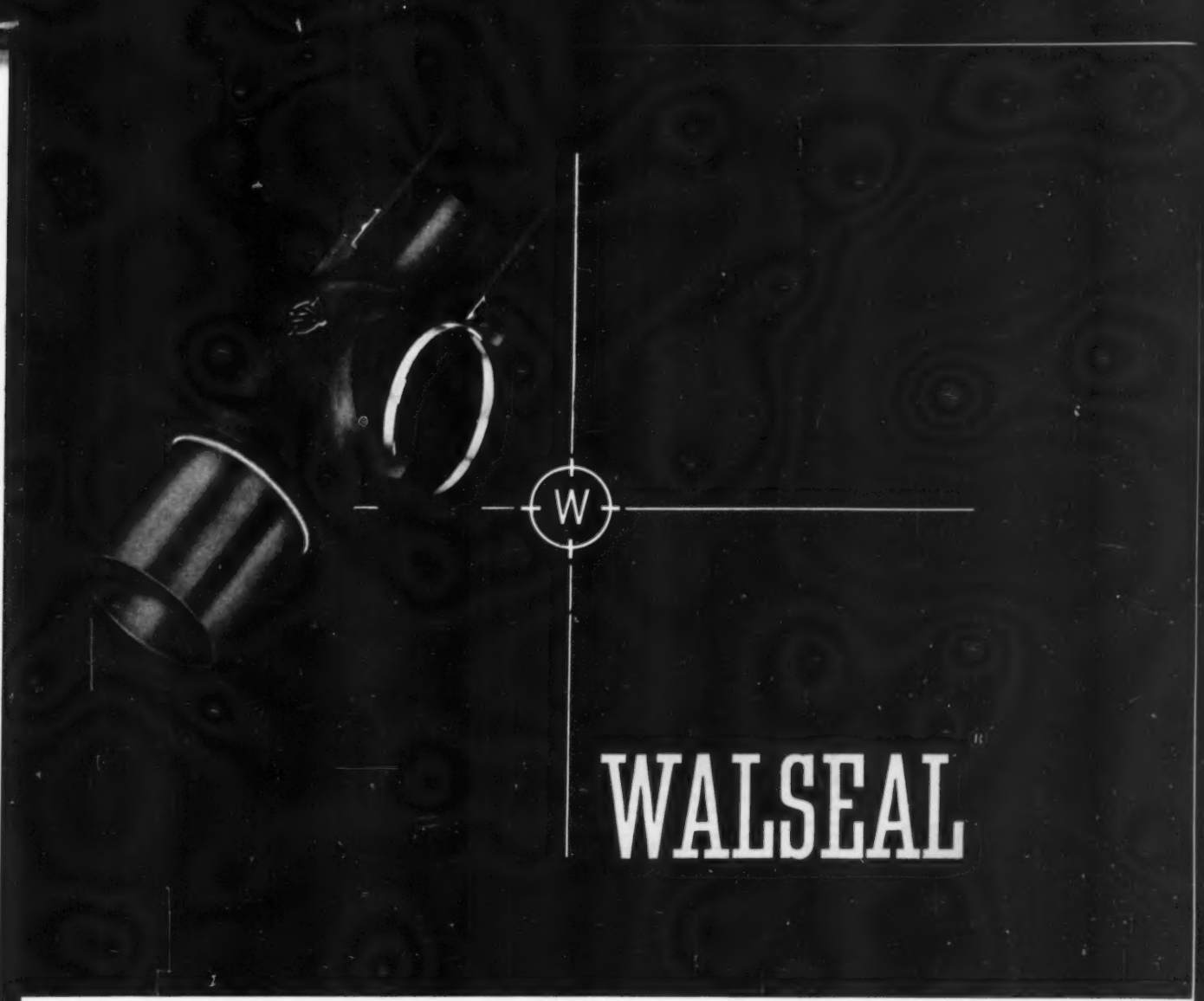
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Semi-annual meeting, June 29, 30, July 1, Denver, Colo.

INSTRUMENT SOCIETY OF AMERICA, 921 Ridge Ave., Pittsburgh 12 — Eighth National Instrument Exhibit, September 21-25, Sherman Hotel, Chicago.

INTERNATIONAL CHURCHMANS EXPOSITION, 19 S. LaSalle St., Chicago 3 — Second annual exposition, October 6-9, Chicago Coliseum. Hall of Church Designs and International Church Buildings Forum will be featured.

SOUTH CENTRAL REGION, NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2 — October 7-9, Mayo Hotel, Tulsa. This region consists of the states of Colorado, Kansas, Oklahoma, Arkansas, Louisiana, Texas and New Mexico.

EIGHTH ALL-INDUSTRY REFRIGERATION AND AIR CONDITIONING EXPOSITION 1346 Connecticut Ave., N.W., Washington 6, D.C. — November 9-12. Cleveland Public Auditorium, Cleveland.

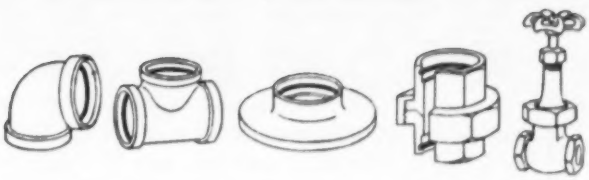


WALSEAL

COMPLETE LINES OF WALSEAL VALVES AND FITTINGS

WALSEAL is a smooth-bore, bronze valve or pipe fitting having a **factory-inserted** ring of silver brazing alloy in the outlet or outlets. The brazed joint that results when a Walseal product is installed is leakproof, vibration-proof, and corrosion resistant. The alloy fillet that appears upon completion of the joint is visual assurance of **full penetration of alloy.** This improved method of joining brass, copper, or copper-nickel pipe or tube is another Walworth contribution to the progress of the valve and fittings industries.

In addition to its complete line of Walseal products, the Walworth Company manufactures complete lines of valves, fittings, unions, and flanges in a wide range of sizes and temperature-pressure ratings. The company also makes three lines of pipe wrenches, the Genuine Stillson, Walco, and Parmelee. Walworth products total approximately 50,000 items and are sold through distributors or agents in all parts of the world.



The sectioned Walseal tee illustrated, shows: (a) the fillet of alloy that appears upon completion of the Walseal joint. This fillet is your visual assurance of complete penetration. (b) the factory-inserted ring of silver brazing alloy. (c) sectioned view of the completed Walseal joint showing penetration of alloy both ways from the insert. Walseal joints can be made only with Walseal valves or fittings. For further details regarding Walseal products, ask for Circular 84.

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NEW BOOKS & REPORTS

Hydraulics Conference Proceedings

Technical papers presented at the eighth annual meeting of the National Conference on Industrial Hydraulics have been published as the *Proceedings of the Conference*. A registration list and lists of officers and committees are included, as well as illustrations and texts of the papers presented September 4 and 5, 1952, in Chicago.

Papers are grouped according to the session at which they were given. These were, General, Automotive, Instrumentation, Pumps, Machine Tools, Aircraft, Hydro Power, Hydraulic Presses, Tractive Equipment and Material Handling, and Accessories.

The conference is sponsored each year by the Graduate School of Illinois Institute of Technology and by the Armour Research Foundation of the Institute, both located at 35 W. 33rd St., Chicago 16.

Velocity and Corrosion

Effects of Velocity on Corrosion by Water is an 8-page general review of 56 technical articles and some unpublished data with emphasis on iron, zinc, copper and their alloys. Where nickel alloyed irons, stainless steels or cupro-nickel behave more beneficially, the comparison is presented. It points out that velocity by itself has little inherent effect on corrosion but does have a decisive effect on many factors that control corrosion rates. The author, H. R. Copson, points out that generally corrosion increases with velocity, but the effect may be just the opposite. Motion may sometimes eliminate and sometimes cause local attack. It may have a marked effect on galvanic couples. At high velocities mechanical damage accelerates attack by erosion corrosion and cavitation erosion.

The article is published by The International Nickel Co., Inc., Dept. EZ. 67 Wall St., New York 5.

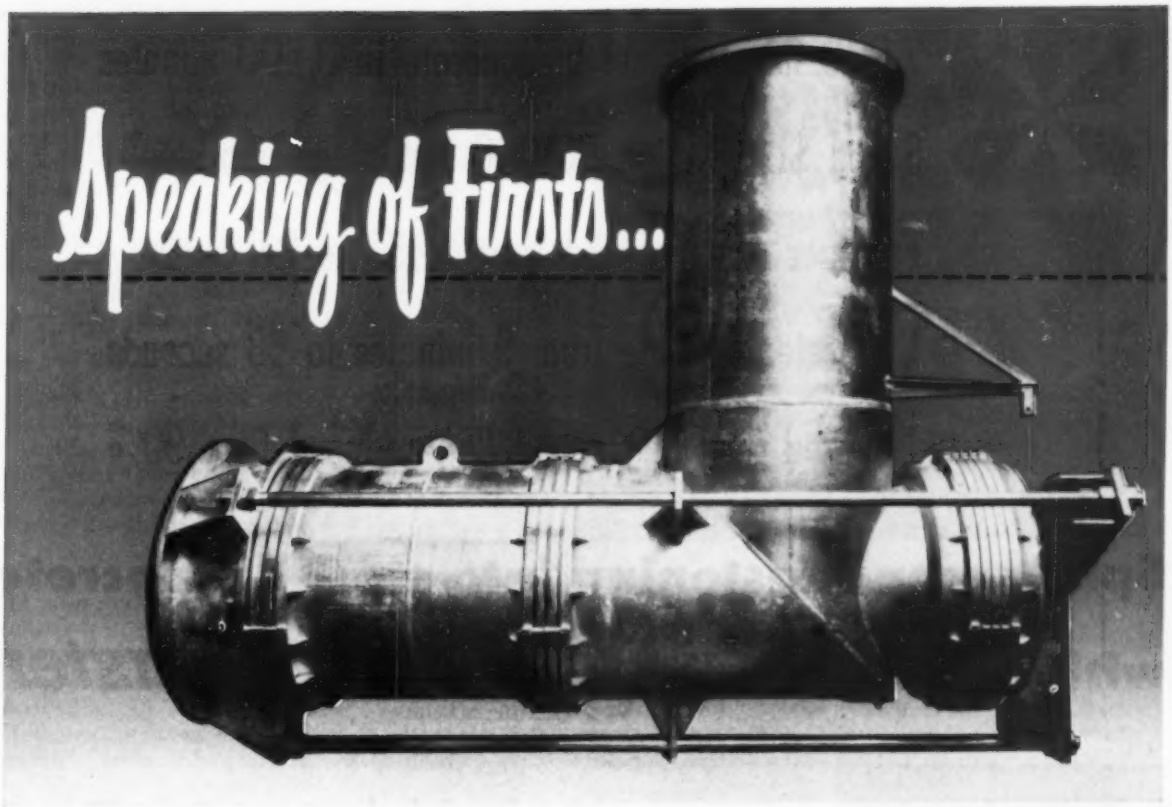
Roof Ventilator Tests

The National Association of Fan Manufacturers, Inc., and the Propeller Fan Manufacturers' Association have announced the adoption of test procedures for power roof-ventilators having either centrifugal or axial type wheels. The object of such tests is to obtain performance for published data and for general application. The test proceddures are outlined in NAFM Bulletin No. 110, *The Standard Test Code for Centrifugal and Axial Fans*, and NAFM Bulletin No. 113, *Laboratory Standards*.

Electric Motor Control

Latest descriptions of the design, construction and application of controllers are included in the new third edition of *Control of Electric Motors* by Paisley B. Harwood, vice president in charge of engineering with Cutler-Hammer, Inc., in Milwaukee.

In revising his book, Mr. Harwood has kept in mind the increasing use of electric motors in various fields. His book is directed not only to professional and consulting engineers, but to motor and machine tool builders and maintenance men in such industries as rubber, textiles, paper, printing and steel.



Recently, Zallea was given the assignment of developing a group of 48-inch expansion joints for flight propulsion test facilities on a classified defense project. The rigid technical specifications of this advanced application required "tailor-made" units for the job, so Zallea engineers analyzed the problem and designed the unusual-looking joint pictured above . . . the first of its kind. Actually, it is a Balanced Pressure, Universal Self-equalizing expansion joint, originally developed by Zallea engineers in 1945, operating at 165 psi and incorporating internal stainless steel turning vanes to provide a smooth flow of gases through the right angle bend. The unit absorbs 3" axial and 1.27" lateral movements through a temperature range from −100° F. to +650° F. No anchors are required since this arrangement neutralizes end thrust developed by internal pressures.

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For detailed information on Zallea Expansion Joints and services write today for a free copy of Bulletin 351.

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Arranged entirely by motor types, the new edition now includes material on automatic regulating systems, and new data for calculating accelerating and decelerating time of a mechanical system. The discussions of d-c and a-c motors cover the operation and characteristics of each motor, the methods used to control it, and the design of the various types of control for that particular motor. Sections on pilot devices and accessories, wiring diagrams and construction details also are given.

Published by John Wiley & Sons, 440 Fourth Ave., New York 16, it contains 533 pages and is priced at $7.50.

The National Association of Fan Manufacturers is located at 2159 Guardian Bldg., Detroit 26.

Housing Research

A Survey of Housing Research, comprising a summary of recent and current housing research and facilities for conducting such research throughout the United States has been issued by the Division of Housing Research, Housing and Home Finance Agency. The survey was made by the Building Research Advisory Board of the National Academy of Sciences under a research contract with the HHFA to ascertain what research is being done in the housing field, where it is being conducted and what facilities are available for further studies. Questionnaires were mailed to 861 educational institutions, foundations, trade associations and professional societies, and commercial laboratories.

Technical problems covered are building materials, structures, mechanical equipment and construction methods. Non-technical subjects include urban studies, general economic and social data, finance, housing regulations and the housing market.

The 723 page volume is available from the Government Printing Office, Superintendent of Documents, Washington 25, D.C., at $3.00 a copy.

Earth Heat Pump Research

Earth Heat Pump Research, Part III is the third progress report on research with an earth heat pump system installed in the mechanical engineering laboratory of the University of Kentucky in Lexington. This latest report gives an account of the performance of an earth heat pump operating intermittently on the cooling cycle from July 1, 1950 to October 1, 1950.

Descriptions of the tests, sample calculations and a discussion of monthly results in graph form are included.

Authors of the series of progress reports are Estel B. Penrod, professor and head of the department of mechanical engineering, and Raymond C. Thornton, research engineer.

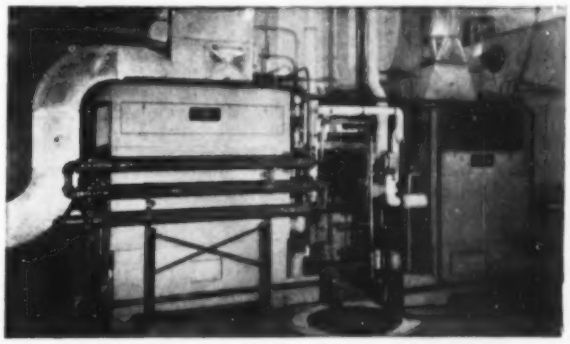
Thermodynamic Properties of Nitrogen

The engineering design of plants to separate nitrogen from natural gas requires accurate data on the thermodynamic properties of nitrogen over a wide range of conditions. To provide charts to the natural gas industry, researchers at the Institute of Gas Technology, affiliated with Illinois Institute of Technology, have recalculated the usual thermodynamic properties of nitrogen on the basis of more recent fundamental data from the published literature.

Thermodynamic Properties of Nitrogen by O. T. Bloomer and K. N. Rao, IGT Research Bulletin No. 18,

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



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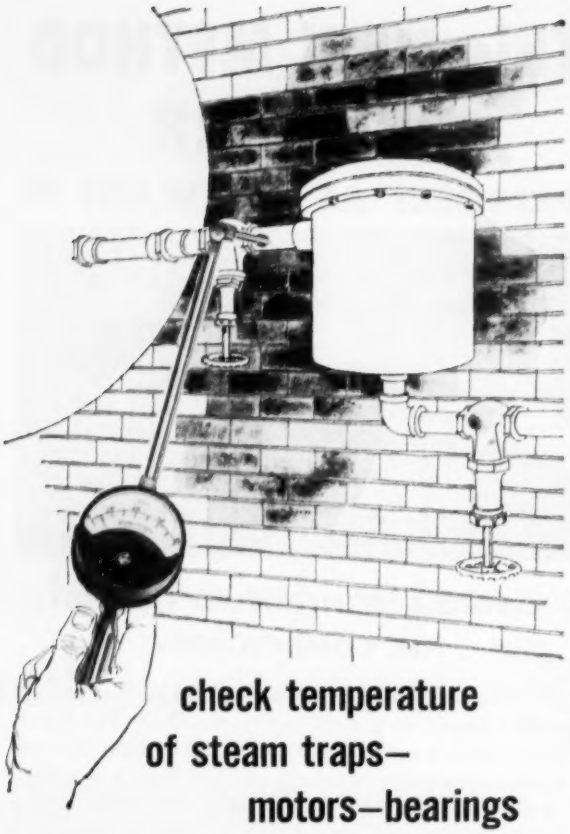

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presents the properties in tabular form and as charts of enthalpy vs. entropy, and of compressibility factor as a function of temperature and pressure. The range of the tables and charts is from saturated liquid at −320.4 deg F to superheated vapor at 500 deg F, and pressures from 10 to 1500 psia. Properties tabulated are specific volume, enthalpy, entropy and the fugacity-to-pressure ratio. For the superheated vapor region, calculations were based on zero-pressure specific heat data and a new equation of state.

As a supplement to the bulletin, the *Mollier Chart for Nitrogen* and *Compressibility Chart for Nitrogen* have been reproduced full scale on heavy paper, 22 in. by 34 in. They are issued as a set only and are sold separately from the bulletin.

The bulletin is available from the Institute of Gas Technology, Technology Center, Chicago 16 at $3.50 a copy.

Electrical Reference

The second edition of Lincoln's *Industrial-Commercial Electrical Reference* has recently been published. A comprehensive source of information for industrial users of electricity, the second edition again is sponsored by the original 115 electrical manufacturers.

The book contains valuable information such as pictures, dimensions and properties of standard equipment, data on methods of installing equipment, data on sizes, weights, dimensions and capacities of all kinds of equipment, and so on. Specific subjects covered are: electrified industry, electrical fundamentals, industrial wiring systems, switchboards and substations, panelboards, electrical control, electrical protective equipment, motors and generators, capacitors, industrial lamps and lighting, industrial electric heating, electric furnaces, electric welding, signal and communication systems, transformers, primary and storage batteries, electronic equipment, measuring instruments, electrical surveys, electroplating and electrolysis, electrical insulation, maintenance equipment, mechanical drives, and a general index, 1951 NEC index and a sponsor list.

Also included are 500 tables, 400 diagrams and more than 1400 illustrations. Complete data on aluminum conductors and equipment ratings are given in addition to all pertinent National Electrical Code Regulations and all appropriate NEMA and ASA standards.

The author, E. S. Lincoln, is a Fellow of the American Institute of Electrical Engineers and has been a consulting engineer for public utilities, industrial plants and electrical manufacturing plants for more than 30 years.

Published by the Electrical Modernization Bureau, Inc., 110 Mamaroneck Ave., White Plains, N.Y., the 1700-page volume is priced at $25.00 a copy.

OTHER BOOKS AND REPORTS

LITERATURE SURVEY OF THE THERMAL CONDUCTIVITY OF LIQUIDS — a bibliography. It is published by the College of Engineering, Louisiana State University and Agricultural and Mechanical College, Baton Rouge 3, and is priced at $1.00 a copy.

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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on this page. If you write direct to the manufacturer, describe fully what you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Adhesive Specifications

HPAC 101—A.I.A. File Folders Nos. 37-D-3 and 37-E contain the Index to Foster Specifications for surfacing thermal insulations. The company now plans to issue bi-weekly bulletins, to be included in the folder, containing information on adhesives, vapor barriers and surface coatings. Each bulletin will include product uses, limitations and specifications. [Manufacturer: Benjamin Foster Co., 4635-37 W. Girard Ave., Philadelphia 31.]

Air Conditioner

HPAC 102—Booklet on "Multi-Zone" air conditioners contains complete description of all construction features and a cut-away photograph showing the interior of the unit. A series of tables show ratings of various sizes, dimensions, fan data and connection sizes. [Manufacturer: Baker Refrigeration Corp., 1508 Evans St., South Windham, Maine.]

Induced Draft Fans

HPAC 103—Catalog describes induced draft bifurcator fans, said to provide controlled draft for boilers and furnaces. This product is a motor driven axial-flow fan in a divided housing. The motor is in an isolated chamber around which flue gases are by-passed. The catalog contains illustrations, specifications and dimensions of the fans in 24 sizes for high pressure boilers delivering up to 60,000 lb of steam per hr and for low pressure boilers rated up to 190,000 EDR. [Manufacturer: DeBothezat Fans Div., American Machine and Metals, Inc., East Moline, Ill.]

Boiler-Burner Unit

HPAC 104—Fourteen-page, four-color catalog describ-

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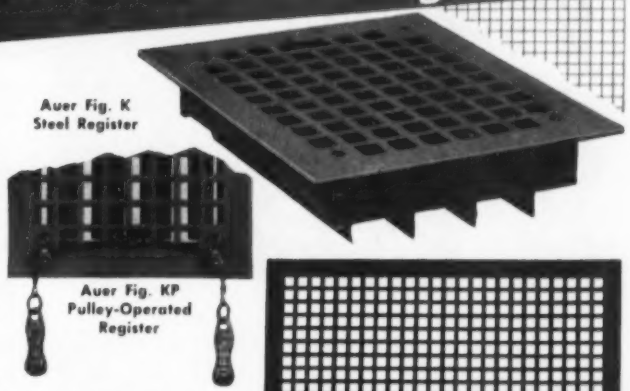

Auer Fig. K Steel Register

Auer Fig. KP Pulley-Operated Register

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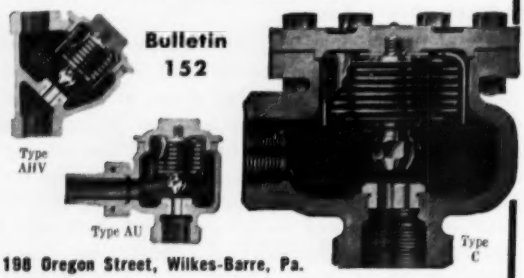

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ing the company's boiler-burner units in oil, gas or oil-gas combinations. A detailed table shows ratings, data and dimensions. Cut-away drawings and line drawings are included. [Manufacturer: Kewanee-Iron Fireman, Kewanee-Ross Corp., 101 Franklin St., Kewanee, Ill.]

Btu Meter

HPAC 105—Instrumentation data sheet No. 10.19-1 describes the operation and application of the company's "Btu Meter" which is designed to simultaneously record differential temperature and flow of a liquid and provide direct readings of Btu's. The instrumentation is applicable to heat exchanger testing, measurement of heat transfer in refrigerating and air conditioning installations and recording of thermal data of processes in pilot plants. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.]

Butterfly Valves

HPAC 106—Bulletin 8503 describes pneumatic butterfly control valves designed to regulate the flow of air, gas, liquids or steam in conjunction with indicating, recording or non-indicating pneumatic controllers. The bulletin contains application data, specifications, dimensions and sizing data. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.]

Close Coupled Pump

HPAC 107—Construction features of a supporting-adapter type, close coupled general purpose pump are described in Bulletin 52B6083A. A table of dimensions is given and diagrammed are the packing or mechanical seal and alternate sealing arrangements available. [Manufacturer: Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee 1.]

Cut-Off Relay

HPAC 108—Bulletin 8504 describes a relay designed for use in electric control circuits to shut down the process when a predetermined control point has been reached. The bulletin contains application and operational data, specifications and installation information. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.]

Deaerating Heater

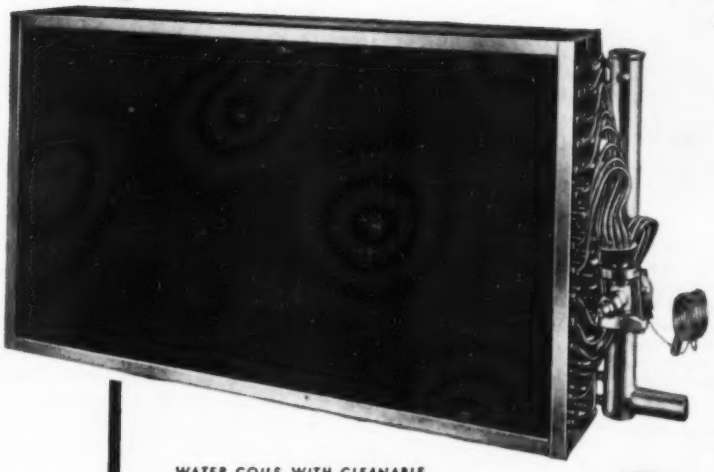
HPAC 109—Bulletin WC-110 describes a packaged, deaerating, spray-type heater for small boiler plants. The heater is designed to reduce oxygen in the heated water to 0.005 ml per liter, regardless of fluctuations in the load or the amount of oxygen or other gases initially present in the feedwater. The vent condenser is of the internal type for maximum compactness. [Manufacturer: Graver Water Conditioning Co., 216 W. 14th St., New York 11.]

Dust Collection Equipment

HPAC 110—A paper on "Operation, Application and Effectiveness of Dust Collection Equipment," originally presented at the Michigan State Industrial Ventilation Course, has been reprinted. It contains charts on costs of dust collecting equipment; range of particle sizes, concen-

EVERY RIGIDBILT PRODUCT A MASTERPIECE OF ENGINEERING DESIGN

RIGIDBILT AIR CONDITIONING COILS



WATER COILS WITH CLEANABLE TUBES ALSO AVAILABLE

These Important Features Assure RIGIDBILT Superiority . . .

Maximum heat transfer by heavy aluminum or copper fins, heavy galvanized steel casings. Extruded fin collar entirely surrounds copper tube. Proper circuiting ratio of tonnage to tube length minimizes pressure drop, increases overall coil efficiency. Tested to 300 lb. air pressure under water. Fin spacings variable for ranges of temperature, air velocity, humidity. Tube sizes variable in height and length. Flanged and punched casings. Entire coil custom engineered.

RIGIDBILT IS BETTER BUILT—Write for Catalog

RIGIDBILT INC.

2852 W. FULTON ST., CHICAGO 12, ILLINOIS

FAST DELIVERY!

AIR CONDITIONING & VENTILATING UNITS • UNIT & PRODUCT COOLERS • HEATING & COOLING COILS
ALSO COILS DESIGNED AND BUILT FOR SPECIAL APPLICATIONS

It's the LOW DOWN DIRT trapped by WILSON'S HAIR FILTERS that GUARANTEES LONGER LIFE

In Wilson *Hair* Filters the entire dust-holding capacity is completely utilized. This means, *no surface dust stopping only*, but Full-Depth Dust Trapping at its best . . . and many extra months of filter life.

The *reasons* are so simple:

1. The hair media in Wilson *Hair* Filters act in the same manner as Mother Nature's proven way of filtering the air you breathe. It's the *hair* that cleans the air . . . more easily, more effectively, more economically.
2. The multi-directional distribution of the hair in Wilson *Hair* Filters literally invites all dust and dirt to come in and be trapped throughout the entire filter interior.
3. Most brands of air filters require oiling on their inlet surfaces. This stops dust prematurely, loads up the incoming air side and materially shortens filter life.

Wilson Hair Filters are not oiled on the inlet side. Instead, they receive an even distribution of mineral oil *on their outlet surface*, which:

(a) augments the already amazing ability of the hair itself, to catch and hold dust, and—

(b) builds an impregnable barrier which halts dust and dirt after reaching the furthermost practicable penetration point.

WILSON & CO., INC.
(Air Filter Division) 4100 South Ashland Ave., Chicago 9, Ill.

Wilson Hair Filters are another quality product of Wilson & Co., world-famous for meat products, sports equipment, pharmaceuticals, hair products, etc.

The famous Edgeseal, the original *Hair* Filter with the patented self-sealing edge.

The popular Honeycomb, the dressed up *Hair* Filter that is so easy to handle.

Save delay. Save dollars. Save doubt. Send for FREE sample with details and prices.

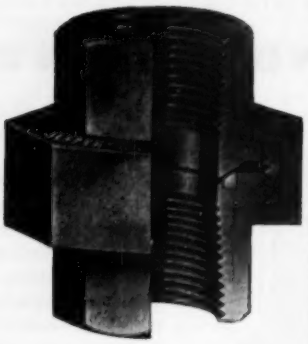
INDOOR COMFORT

WILSON'S HAIR FILTER

WILSON & CO.

Want to save . . . now and later?

Then put
JEFFERSON
Air-tested
Malleable Iron
UNIONS
to work . . the UNIONS with the RECESSED BRASS SEAT and the true ball joint

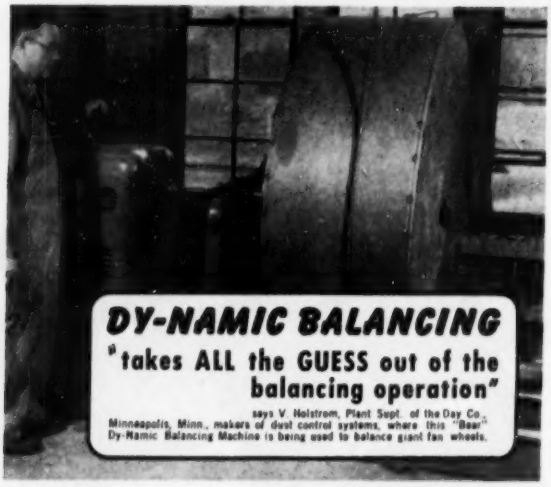


Time and labor are definitely saved through the use of Jefferson Specialty Unions. This is a fact because there are types which mean fewer joints and then there is always the exclusive Recessed Brass Seat which makes up tight without undue wrench pressure . . . a joint which is truly spherical. Then, too, octagonal ends make it possible to use any type wrench. All these features add up to less chance of leakage and less maintenance. The "Jefferson" name has always stood for quality, the kind that you can depend on for long, care-free service. OWG 2000# to 2"; 1000# up to 4".

The Jefferson line includes AAR male and female unions, Enduro 300#, Excel 250# and Master 150# Unions. All-iron seats are also available.

Contact your nearest distributor for your requirements.

JEFFERSON UNION COMPANY
607 West 26th St., New York 1, N.Y.
65 Gooding St., Lockport, N.Y.
35 Fletcher Ave., Lexington 73, Mass.


DY-NAMIC BALANCING
"takes ALL the GUESS out of the balancing operation"
says V. Holstrom, Plant Supt. of the Day Co., Minneapolis, Minn., makers of dust control systems, where this "Bear" Dy-Namic Balancing Machine is being used to balance giant fan wheels.

SIMPLIFIED OPERATION of "Bear" Dy-Namic Balancing Machines is so fast, so economical, so easy to learn that manufacturers, maintenance shops and others are employing this revolutionary method with top-production results. No complicated manipulations to learn! Average shop man can learn to balance in a few hours! Get full details by sending for **FREE DY-NAMIC BALANCING MANUAL** . . . tells how you can eliminate noise and vibration, reduce wear and improve performance of rotating parts, *quickly, accurately,* and *economically.* Write: Bear Mfg. Co., Dept. H-16, Rock Island, Ill.

6040

"BEAR"
STATIC AND DY-NAMIC BALANCING MACHINES
balance rotating parts weighing from 4 oz. to 8 tons

trations and collector performances; drawings of different types of dust collectors; list of practical "don'ts"; and other data on the selection, installation and operation of dust collection equipment. [Publisher: American Air Filter Co., Inc., 373 Central Ave., Louisville 8.]

Electrode Rapper

HPAC 111—Six-page bulletin contains illustrated information on the recently developed magnetic impulse continuous electrode rapping system for electrostatic precipitators. Operation of this system is explained with circuit diagrams and photographs of major components. [Manufacturer: Research Corp., Bound Brook, N. J.]

Engineering Data for Heating Systems

HPAC 112—Engineering Data Manual, No. 2695 contains detailed, illustrated information pertaining to heating problems. Heating terminology is covered and there are sections on steam data, water properties, piping data, weights and measures, and pipe and fitting dimensions. One chapter is devoted to temperature conversion formulas, decimal equivalents, electrical unit equivalents, number of gallons in round and rectangular tanks and weights of sheet steel. [Publisher: C. A. Dunham Co., 400 W. Madison St., Chicago 6.]

Gas and Oil Equipment

HPAC 113—Spiral-bound, 104-page catalog contains hundreds of illustrations and descriptive data on gas and oil equipment. Special feature is a 22-page "Useful Information" section complete with tables, charts, facts, servicing and installation aids. In addition, two separate indexes have been included, a general classification index in the front of the catalog and a product index in the back. [Publisher: Bervic Co., 760 Tolland St., East Hartford 8, Conn.]

Gear Motors

HPAC 114—Catalog of products and services includes specifications and illustrations of synchronous and non-synchronous instrument motors, series "500" gear reduction motors and temperature controls, complete with rating charts and mounting dimensions. A list of possible applications is included. [Manufacturer: Gleason-Avery, Inc., 45 Aurelius Ave., Auburn, N. Y.]

Heat Transfer Equipment

HPAC 115—Catalog, with illustrations and tables, covers heat transfer equipment for refrigeration and air conditioning applications. Equipment described includes: cleanable and counterflow condensers, both shell-and-coil and shell-and-tube; liquid receivers; stainless steel evaporators; and adjustable capillary valves. [Manufacturer: Standard Refrigeration Co., 332 S. Hoyne Ave., Chicago 12.]

Hose Couplings

HPAC 116—Eight-page bulletin describes "Le-Hi Quick-Lock" hose couplings and fittings for air, water, gas, oil, hydraulic or steam lines. The bulletin tells how the U-shaped gasket, expanding under line pressure, is designed to provide a tight seal under all working pressures from 10 to 2000 lb in hydraulic service, or 1500 lb in nonpoisonous, noninflammable gas service. Six types

FOSTER MEANS...

Quality

IT TOOK A FLOOD TO KNOCK IT OUT! After 29 years of continuous, trouble-free service in the water supply system of a northern New Jersey Township, this Foster 6" Type U Pressure Regulator was temporarily put out of service by a flash flood. A new Foster Type U Regulator is now on the job, and the old valve, factory overhauled, is now ready for many more years of service.

... and QUALITY means

Dependable, Trouble-free Service

To give dependable regulation, a valve must be able to meet service requirements without compromise.

There is a specific type of Foster automatic valve for every service need. Each valve is engineered and built to do its job with a comfortable margin to spare, which means low maintenance.

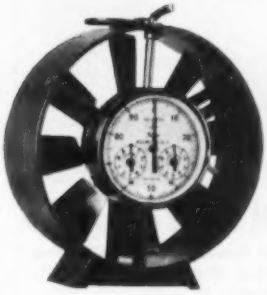
This is the reason that Foster valves, over the years, have established a record for dependable performance second to none.

The next time you need a pressure regulator, it will pay you to tell the Foster Representative your requirements.

PRESSURE REGULATORS • RELIEF AND BACK PRESSURE VALVES • CUSHION CHECK VALVES • FAN ENGINE REGULATORS • PUMP GOVERNORS • TEMPERATURE REGULATORS • FLOAT AND LEVER BALANCED VALVES • NON-RETURN VALVES • VACUUM REGULATORS OR BREAKERS • STRAINERS • SIRENS • SAFETY VALVES • FLOW TUBES

FOSTER ENGINEERING COMPANY · UNION, N. J.

HOW FAST?

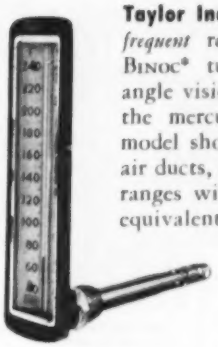


Taylor Biram's Anemometer is designed for use in air ducts, tunnels, furnaces, flues, etc. The three dials register velocity of air currents to 10,000 ft. Each instrument is tested and a chart of corrections furnished for velocities of from 200 to 3,000 ft. per minute. **Catalog #3132. Price $75.00.**

HOW MOIST?

Taylor Sling Psychrometer is considered the basic standard for accurate measurement of relative humidity, since it provides a simple means for creating suitable circulation of air. Length 12". Catalog No. 1321: 30° to 200° in 1° divisions—**$9.00.** Catalog No. 1322: 20° to 120° in ½° divisions—**$9.00.** Catalog No. 1324; 25° to 40° in 1/10° divisions—**$13.00.**

HOW COLD?

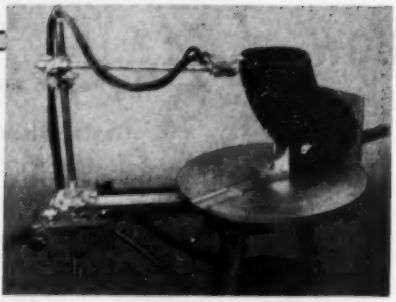


Taylor Industrial Thermometers invite *frequent* reading, thanks to exclusive BINOC® tubing which provides wide angle vision and high magnification of the mercury column. The 90° angle model shown is especially suitable for air ducts, dry kilns etc. Many standard ranges within minus 50 to +400°F or equivalent Centigrade. Your choice of stem angles and connections. Thermometer illustrated (Range 0° to 160°F, 6" stem, 9" scale). **Catalog #12EU349. Price $25.25.** ®Reg. U. S. Pat. Off.

There is a Taylor Instrument or control system for every air conditioning need. Ask your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.*

Taylor Instruments

MEAN ACCURACY FIRST



HERE'S HOW TO

Save WELDING FITTINGS

Use this new precision "Universal" Flame Cutter for re-working, reconditioning and salvaging all types of new and used welding ells, tees, flanges, reducers, etc. Makes extremely clean cuts . . . no cleaning or hand fitting required. Adjustable degree plate permits fitting to be cut at any angle. Has unitized control panel and unitized gas control valve.

WHAT THE VERNON "UNIVERSAL" FLAME CUTTER DOES

- Shortens ells, tees, flanges, reducers, etc.
- Miters welding neck flanges.
- Re-cuts and bevels used ells, tees, swedges, returns.
- Reconditions welding neck and slip-on flanges.
- Reams extra heavy fittings to standard.
- Cuts small miters . . . 22½° or less.
- Cuts holes in blanks for slip-on reducing flanges.
- Cuts and bevels short pieces of pipe to 36" diameter.
- Makes swedges out of welding caps.
- Cuts miter elbows.

THE NEW VERNON

Write for Bulletin FC-2

"Universal" FLAME CUTTER

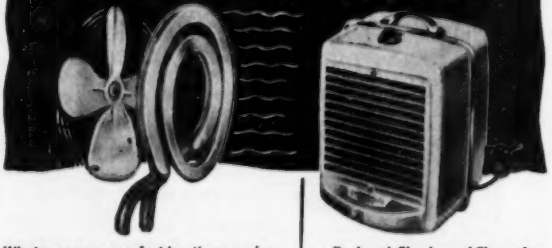
VERNON TOOL CO., LTD.

1109 Meridian Ave. Alhambra, Calif. P.O. Box 7555 Houston 7, Texas

Vernon PIPE CUTTING PANTOGRAPH
Vernon "Universal" FLAME CUTTER
Brown STEEL VALVES
Vernon-Ormsco TUBE EXPANDING MACHINE

FOR "EXTRA" COMFORT HEAT
At Low Cost

CHROMALOX Blower-type Electric UNIT HEATERS



Whatever your comfort heating requirements, there's a CHROMALOX Electric Unit Heater that fits the picture exactly. Portable, mounted, built-in—blower-type, natural convection or radiant types—¼ to 40 KW. All with famous, long-lasting CHROMALOX totally enclosed heating elements. CHROMALOX quality construction throughout. Available with automatic and manual controls.

- Enclosed, Shockproof Chromalox Heating Element.
- Quiet, Dependable.
- Long Service Life.
- Easy, Low Cost Installation.
- A Size and Type for Every Requirement.

WRITE FOR CATALOG 50

It shows complete line of Unit Heaters of portable, mounted and built-in-wall types.

EDWIN L. WIEGAND COMPANY, 7610 THOMAS BOULEVARD, PITTSBURGH 8, PA.

CHROMALOX 50-19

ELECTRIC HEATING AT ITS BEST!

and where they are to be used, are discussed. [Manufacturer: Hose Accessories Co., 2704 N. 17th St., Philadelphia 32.]

Humidity Control

HPAC 117—Reprint of a magazine article tells how proper humidity and drying conditions, with a "Kathabar" unit, were provided for the William Wrigley Gum Co. for manufacturing a candy-coated gum. The manufacturing and drying processes are explained in detail. [Publisher: Surface Combustion Corp., 2375 Dorr St., Toledo 1.]

Insulated Conduits

HPAC 118—Folder with schematic diagrams describes prefabricated-preinsulated conduits. Shown are standard fittings, typical anchorage and specifications for expansion compensatory arrangements. [Manufacturer: Beltran Associates, Inc., 225 Lafayette St., New York 12.]

Needle Valves

HPAC 119—Specifications and dimensions of gland-type needle valves are given in circular 568. These valves are applicable to instrument lines, orifice meters, gages, by-passes and fine regulations of gages and liquids. [Manufacturer: The Lunkenheimer Co., Waverly and Beekman Sts., Cincinnati 14, Ohio.]

Power Measurement Transducers

HPAC 120—Bulletin 15-16 contains technical data on the application of power measurement transducers to process control. Technical application data on all subjects are given such as salt operation, pulverizing, clay mixing, sodium production and measurement and control of a-c power plus the measurement and control of d-c power. Engineering descriptions of applications of thermal converters, solenoid-plunger ammeter, torquemeter, vacuum thermocouple, rectifying current system, precision shunt, saturable reactor and magnetic amplifier are covered. Diagrams, tables of characteristics and mathematical formulas are included. [Publisher: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.]

Pressure Regulators

HPAC 121—Catalog 29 describes the constant pressure differential regulator and the instrument air pressure regulator. These units are used for regulating air pressure to pneumatic instruments, manually loading pneumatic instruments and for supplying constant flow rate air supply to manometer purge lines, pneumatic liquid level measurement and pneumatic liquid density measurement. Photographs, line drawings and performance characteristics are included. [Manufacturer: Fischer & Porter Co., 600 County Line Rd., Hatboro, Pa.]

Printing Calculator for Contractors

HPAC 122—"Figure-Fact Efficiency for Contractors and Builders" is the subject of folder AD535 on the company's "Printing Calculator." It is used for estimating, figuring costs, payroll computations, insurance records, extension of bills, tax computations and so on. The calculator is designed to combine short cut multiplication and automatic division with high speed listing, adding and subtraction, and gives printed proof of every factor on tape. Five single sheet application flyers explaining

W. S. ROCKWELL
Butterfly VALVES

for

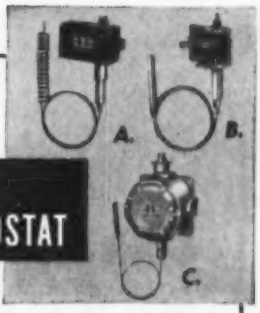
- AIR CONDITIONING
- HEATING SYSTEMS
- DUST COLLECTING
- VENTILATING SYSTEMS
- WATER PIPING
- DRAINING & FILLING

Made of any metal or rubber lined, in all standard pipe sizes to 72" and in special fabricated types for round or rectangular ducts, piping and equipment; pressure to 600 p.s.i. Flanged or threaded. Manual or automatic controls. Easy to operate and clean. Quick regulating and closing.

Rockwell valves also made in slide types in sizes to 24".

Get Rockwell Valve Catalog and ask to receive Rockwell Valve News monthly.

W. S. ROCKWELL CO. 2543 Eliot Street Fairfield, Conn.



A. TYPE E5

B. TYPE F42

C. TYPE E98

AN ACCURATE ADAPTABLE THERMOSTAT

The type E5 thermostat is a precision-built temperature control which can be fitted with a wide variety of thermal assemblies and switches to suit the particular application. Temperature limits -150° F to +600° F.

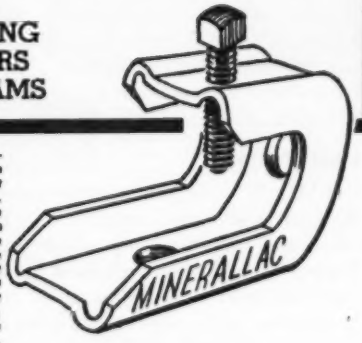
The type E5 has been used on ovens, water baths, incubators, hot plate presses, cooling cabinets, air conditioning equipment, food and drink vending machines. Shown are three variations, the E5 covered by bulletin #3-2, Type F42 "skeleton" model covered by bulletin #3-3, and Type E98 in explosion-proof housing covered by bulletin #3-5. Write for information on the models of interest to you.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street, Watertown, Mass.

STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

MINERALLAC BEAM CLAMPS

FOR MOUNTING HANGERS ON I-BEAMS



Mounts Minerallac hangers No. 0 to No. 6 on I-Beams safely without necessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, these durable, light weight beam clamps have ¼-20 tapped holes—will fit beam flanges up to ½ inch thick. Furnished with case-hardened set screw. Low cost.

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manufacturers' agents:*

Schwan "Packaged" power-type GAS BURNER

Schwan PACKAGED burners are shipped completely assembled with all parts. No critical adjustments or difficult installations. Gas connected to pipe union; electricity through limit controls to burner-panel terminals. That's it!

FOR IMMEDIATE SHIPMENT: 10 sizes (600,000 to 10,000,000 BTU)

*OPPORTUNITY for representatives with some combustion engineering experience. For full details about territories, WRITE TO—

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BETTER WELDING
AT LOWER COST
"CONSTELLATION" LINE
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ARC WELDERS
ATTENTION . . .
Heating and Air Conditioning men, here is the equipment to handle speedy construction, installation and maintenance jobs with perfection and simplicity.
Built for endurance yet extremely portable. The Trindl Line of Arc Welders range in output from 30 to 400 amperes and incorporate all of the latest engineering features.
8 outstanding models designed to meet the demand of industry.
Shipped complete including insulated operating accessories.
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Monarch
NOZZLES
for
AIR
WASHERS
These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.
Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.
Write for Catalog 6-A
MONARCH MANUFACTURING WORKS, INC.
2523 E. ONTARIO ST. PHILA. 34, PENNA.
CANADIAN SALES AGENT (EXCEPT B.C.) CANADIAN GENERAL FILTERS LTD., 2679 DANFORTH AVE., TORONTO 13.

various construction engineering and other figure work procedures are also available with the folder. [Manufacturer: Remington Rand Inc., 315 Fourth Ave., New York, 10.]

Protective Coatings

HPAC 123—Five bulletins describe the company's 100 Series of tar base protective coatings. One bulletin gives specifications, uses and methods of applying all four coatings in the series. Other bulletins give detailed information on heavy duty coating; thin, high gloss coating; coating for surfacing exposed to corrosive vapors, dilute acids and alkalies, and coating for protection of drinking water piping and tank interiors. [Manufacturer: Pittsburgh Coke & Chemical Co., Protective Coatings Div., Room 1953, Grant Bldg., Pittsburgh 19.]

School Heating

HPAC 124—Booklet SA 2057 outlines five suggestions for improving the thermal environment of classrooms to the mutual advantage of teacher and pupil. Based on the premise that overheating in schools makes students drowsy and difficult to instruct, such points as the effects of solar energy, the danger of post-luncheon "black-outs," how to adjust classroom temperatures for high or low activity classes and why teachers generally require warmer room temperatures than their students, are covered. [Publisher: Minneapolis-Honeywell Regulator Co., Merchandising Div., 2753 Fourth Ave., So., Minneapolis 8.]

Soldering Manual

HPAC 125—Bulletin 105-D, "The New Way to Solder," explains resistance soldering and outlines its uses for production and maintenance in industry. The brochure also contains operating instructions for using the "Wassco Glo-Melt" resistance soldering unit and its accessories. [Manufacturer: Wasserlein Mfg. Co., Inc., 126 W. Cass St., Joliet, Ill.]

Steam Throttle Valves

HPAC 126—Special features of the steam throttle valve are described such as the non-rotating stem design, stuffing box, thrust bearing, double-seated balance type valve construction, safety attachment, operating control and type ends. Also included are a parts list for a 3-in. steam valve and shipping information. [Manufacturer: Brown Valve Div., Vernon Tool Co., Ltd., 1101 Meridian Ave., Alhambra, Calif.]

Steel Tubing

HPAC 127—General catalog covers seamless and mechanical steel tubes, seamless and welded stainless steel tubes and stainless and carbon steel welding fittings. Typical applications, chemical and physical analyses, sizes and tolerances are included for the various types. A selection table covering stainless steel, alloy steel, carbon steel and high purity ingot iron is included. [Manufacturer: Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee 46.]

Temperature and Pressure Relief Valves

HPAC 128—Folder FN-40 illustrates and describes a complete line of automatic, self-closing temperature and pressure relief valves. Models for residential, commercial, industrial and institutional systems are described.

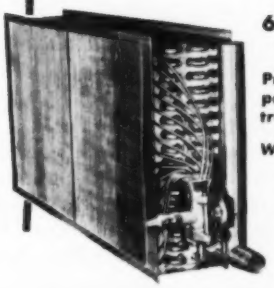
Air Cooling COILS

2 to 15 Ton CAPACITY

NEW Complete Line

REMPE

COMPLETE WITH MULTI-OUTLET EXPANSION VALVES MADE-ON— READY TO INSTALL



4 Row Coils — for residential jobs.

6 Row Coils — for commercial jobs.

Precision built to insure top performance and to give trouble-free service.

Write for bulletins and prices.

Complete facilities for fabrication of pipe coils — all types — all materials. Engineering service. Send details for price.

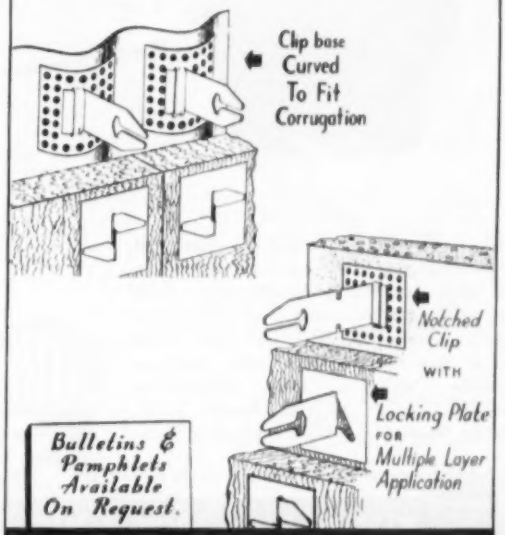
HEAT TRANSFER EQUIPMENT REMPE CO. Founded 1890

REMPE COMPANY

342 N. Sacramento Blvd., Chicago 12, Ill.

Use Stic-Klips For Insulation Installation on CORRUGATED or PLANE building surfaces

● METAL ● MASONRY ● CINDER BLOCK ● WOOD



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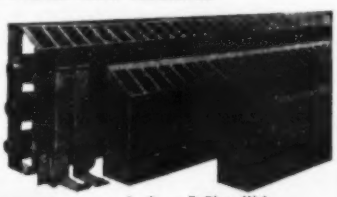
Basevector

HIGHER & FASTER HEAT TRANSFER

Economy, attractive design, higher and faster heat transfer as well as noiseless operation make Basevector the best in industrial and commercial perimeter radiation. Expanded metal enclosures are available. Your opportunity to offer Warm Wall heating at its best.



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1, 2, or 3 Tiers High

Baseline Mfg Corp 3117 NORTH WASHINGTON AVE MINNEAPOLIS 11, MINN.

In addition to Basevector our regular Baseline Baseboard Radiation is saving money every day for heating contractors. BASELINE THE BESTLINE

AGITAIR® "FM" AIR FILTERS

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- Large Dust Holding Capacity
- Stay in Service Longer
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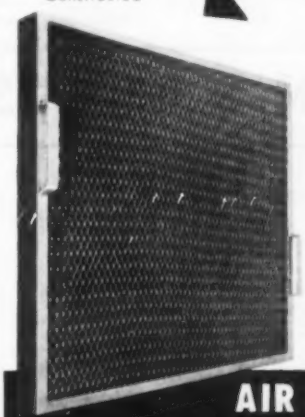
Lower Installation Costs

Lower Maintenance Costs



You can be sure of better air filtration with AGITAIR "FM" permanent, cleanable filters. Scientifically designed to filter with greater efficiency at 432 fpm. Two FM's do the work of three conventional type filters . . . 1/3 less space required . . . fewer units to be installed . . . fewer units to service . . . overall installation and maintenance costs reduced to a minimum.

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HPAC 129—Bulletin A-706 describes the "T2T" temperature primary element transmitter as a resistance thermometer temperature element designed to operate in conjunction with the company's "Autronic" controlling and recording system. Consisting of four pages, the bulletin is illustrated with photographs, line drawings and schematic diagrams showing principles of operation. Technical data such as available temperature spans, over-all and mounting dimensions are included. [Manufacturer: Swartwout Co., 18511 Euclid Ave., Cleveland.]

Test Chambers

HPAC 130—Instrumentation data sheet No. 11.0-6 describes the instrumentation of Hieatt Engineering Co. environmental test chambers. Included are details of operation, basic instrumentation requirements and illustrations covering both the test chambers and the instruments. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.]

Testing Methods

HPAC 131—Eighty different methods for testing, inspecting and analyzing approximately 90 different types of products are listed in this new folder. Prepared to show industry and business the scope of services available, some of the methods described are: non-destructive testing, testing for performance, corrosion resistance, protective coatings; chemical analysis; development of specifications; product certification, and the seal of approval. A description of testing facilities is included. [Publisher: American Standards Testing Bureau, Inc., 44 Trinity Place, New York 6.]

Timing Relays

HPAC 132—Sixteen-page bulletin features the company's complete line of timing relays. Fluid dashpot, pneumatic and electronic timers are described. It also contains information on applications, and operation and engineering data. Timers are shown in a variety of standard enclosures. A selector chart is provided along with suggestions on the various factors to consider in choosing a timing relay for a particular application. [Manufacturer: Allen-Bradley Co., 1335 S. First St., Milwaukee 4.]

Warm Air Panel Heating

HPAC 133—Folder describes the split system of warm air panel heating. Featured are the counterflow system and the single-duct system which utilize the hollow cores of precast concrete slabs to combine the benefits of both circulated air and radiant panel heating. Diagrams illustrate air flow and installation procedures. [Manufacturer: The Flexicore Co., Inc., 1932 Monument Ave., Dayton 2, Ohio.]

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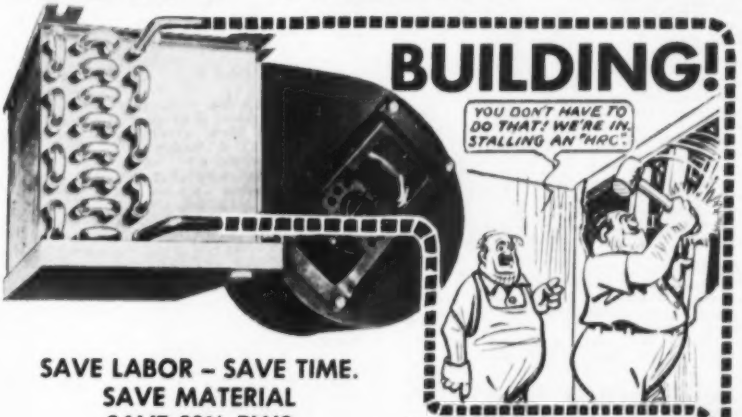

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INDEX TO ADVERTISERS

A-J Mfg. Co. *
Acme Industries, Inc. *
Aerofin Corp. *
Air Devices, Inc. 211
Air-Maze Corp. 184
Airtemp Div. of Chrysler Corp. 153
Airtherm Mfg. Co. 179
Aladdin Heating Corp. *
Alco Valve Co. 52
Aldrich Co. *
Allen-Bradley Co. *
Allen Mfg. Co., W. D. 204
Allis-Chalmers Mfg. Co. 10 & 11
Alloy Steel Products Co., Inc. 49
Alstrom Corp., The *
American Air Filter Co. 8 & 9
American Blower Corp. 35
American Brass Corp., The 150
American District Steam Co., Inc. 56
American Hair & Felt Co. *
American Radiator & Standard Sanitary Corp. 189
Ames Iron Works *
Anderson Co., V. D. *
Anemostat Corp. of America 39
Armstrong Cork Co. 171
Armstrong Machine Works *
Ashcraft Co. 209
Atlas Mfg. Co. *
Auer Register Co. 203
Aurora Pump Co. 193
Autorad, Inc. *

Babcock & Wilcox Co. *
Badger Manufacturing Co. 155
Barber-Colman Co. *
Barnes & Jones, Inc. *
Baseline Manufacturing Corp. 211
Bear Mfg. Co. 206
Bell & Gossett Co. 19, 60
Binks Mfg. Co. *
Bishop & Babcock Mfg. Co., The *
Bituminous Coal Institute 26
Black & Decker Mfg. Co. 198
Blaw-Knox Corporation *
Boiler Engrg. & Supply Co. *
Bonney Forge & Tool Works *
Brunner Mfg. Co. *
Bryant Heater Div., Affiliated Gas Equip. 20
Buffalo Forge Co. 22
Buffalo Pumps, Inc. 59
Bullard Co., The *
Bundy Tubing Co. 47
Burnham Corporation *
Bush Mfg. Co. *
Byers Co., A. M. 4

Campbell Heating Co. *
Canton Stoker Corp. *
Carnes Co., W. R. *
Carrier Corp. *
Cash Co., A. W. *
Century Electric Co. 31
Chase Brass & Copper Co. 57
Chester Cable Corp. *
Chicago Blower Corp. 58
Chicago Pump Co. *
Clarage Fan Co. Inside back cover
Clark Mfg. Co. *
Cleaver-Brooks Co., Boiler Division *
Combustion Engineering—Superheater Inc. 30
Committee on Steel Pipe Research of American Iron & Steel Institute 34
Connor Engrg. Co., W. B. 55
Continental Air Filters, Inc. *
Copeland Refrigeration Corp. *
Crane Co. 23
Crocker-Wheeler Div., Elliott Co. *
Curtis Refrigerating Machine Co. *
Cyclotherm Div., U. S. Radiator Corp. *

Davis Engineering Corp. *
De Bothezat Fans Division American Machine & Metals, Inc. 169
De Laval Steam Turbine Co. *
Delavan Mfg. Co. *
Delco Prods. Div., General Motors Corp. 164
Detroit Controls Corp. *
Detroit Stoker Co. *
Dodge Mfg. Co. *
Dole Refrigerating Co. 190
Dole Valve Co. *
Dollinger Corp. 16 & 17
Dravo Corp. *
Drayer-Hanson, Inc. 213
Dunham Co., C. A. 25
Durant Insulated Pipe Co. 162
Duriron Co., Inc. 192
Duro-Dyne Corp. 155
Dutton Boiler Div., Hapman-Dutton Co. *

Eagan Co., Inc., Walter H. *
Eclipse Fuel Engrg. Co. *
Economy Pumps, Inc. *
Emerson Elec. Mfg. Co. 177

Farr Co. 7
Fedders-Quigan Corp. 53
Field Control Div., H. D. Conkey & Co. *
Fisher Governor Co. 152
Fitzgibbons Boiler Co., Inc. *
Flexitallic Gasket Co. *
Foster Co., Benjamin *
Foster Engineering Co. 207
Foster Wheeler Corp. *
Frick Co. *
Fulton Sylphon Co. *

G. & O. Mfg. Co., The *
Gallaher Co. *
General Blower Corp. *
General Controls Co. *
General Electric Co. *
General Fittings Co. 193
Glasfloss Corp., The *
Glass Fibers, Inc. *
Globe Steel Tubes Co. *
Gorton Heating Corp. 212
Goulds Pumps, Inc. 161
Governair Corp. 172
Grabler Mfg. Co. *
Greenlee Tool Co. *
Grinnell Co., Inc. Inside front cover
Gustin-Bacon Mfg. Co. 51

Hajoca Corporation *
Halstead & Mitchell 187
Hamilton-Thomas Corp. *
Handy & Harman *
Hastings Instrument Co. *
Hayes Furnace & Mfg. Co., Inc. *
Heil Process Equipment Corp. *
Headrick Mfg. Co. *
Henry Valve Co. *
Hoffman Specialty Co. *
Howell Electric Motors Co. *
Hussey & Co., C. G. *

Ilg Electric Ventilating Co. *
Illinois Engineering Co. *
Illinois Testing Laboratories, Inc. 202
Independent Register Co. *
Industrial Sound Control Inc. *
Infra Insulation, Inc. 64
Iron Fireman Mfg. Co. 32

Jackson & Church Co. *
Jefferson Union Co., Inc. 206
Jenkins Bros. 166
Johns-Manville 183
Johnson Co., S. T. *
Johnson Service Co. *
Joy Mfg. Co. *

Keasbey & Mattison Co. *
Keckley Co., O. C. *
Kennard Corp. *
Kennedy Valve Mfg. Co., The *
Kewanee-Ross Corp. *
Key Co. *
Korfund Co., Inc., The 188
Kramer Trenton Co. 180
Kritzer Radiant Coils, Inc. *

Ladish Co. 181
La Herco Industries *
Lee Corporation, The *
Leslie Co. *
Lewin-Mathes Co. *
Lincoln Electric Co., The *
Lunkenheimer Co., The 149

Maid-O'-Mist, Inc. *
Malleable Iron Fittings Co. *
Manning & Lewis Engineering Co. *
Marley Co., The 182
Marlo Coil Co. *
Marsh Heating Equipment Co. 54
McCord Corp. *
McDonnell & Miller, Inc. Outside back cover
McQuay, Inc. *
Mercoid Corp., The 178
Mettler Co., Inc., The *
Mid-Continent Metal Products Co. *
Midwest Piping & Supply Co. *
Minerallac Electric Co. 209
Minneapolis-Honeywell Regulator Co. 14 & 15
Miracle Adhesives Corp. *
Mitchell Co., John E. *
Modine Mfg. Co. 50
Monarch Mfg. Works, Inc. 210
Muckle Mfg. Co. 224
Mueller Furnace Co., L. J. 186
Multi-Vent Div., Pyle-National Co., The *
Mundet Cork Co. *
Mystik Adhesives Products *

Nash Engineering Co. 72
National Tube Div., United States Steel Corp. *
Nelson, Herman Div. of American Air Filter Co., Inc. 194 & 195
Nesbitt, Inc., J. J. 68
New York Blower Co., The *
Niagara Blower Co. 201
Nicholson & Co., W. H. 204

Ohio Brass Co. *
Ohio Injector Co. *
Olson & Company, Arthur A. 165
Orr & Sembower, Inc. *
Owens-Corning Fiberglas Corp. *

Packless Metal Products Corp. *
Paley Mfg. Corp. *
Paragon Electric Co. *
Patterson-Kelley Co. 61
Peerless Elec. Co. 159
Peerless Pump Div., Food Machinery & Chemical Corp. 63
Penn Controls, Inc. *
Penn Ventilator Co. *
Perfex Corp. *
Pittsburgh Corning Corp. 37
Porter & Co., H. W. 33
Powell Co., The Wm. *
Powers Regulator Co., The facing page 52
Preferred Utilities Mfg. Co. *
Pritchard Co., J. F. *
Propellair, Inc. 176

Pur Air Div., American Solvent Recovery Corp. *
R P & C Division American Chain & Cable Co., The 62
Ramset Fasteners, Inc. 200
Reading Tube Corp. *
Ready-Power Co., The *
Refinite Corp. *
Register & Grille Mfg. Co. *
Rempe Co. 211
Republic Steel Corp. *
Revere Copper & Brass, Inc. 71
Ric-wiL Co., The *
Ridge Tool Co. *
Rigidbilt, Inc. 205
Rochester Products, Div. of General Motors Corp. 163
Rockwell Co., W. S. 209
Rome-Turney Radiator Co. *

Sarco Co., Inc. 40
Sarcotherm Controls, Inc. 41
Sall Bros. Co. *
Schaub Engineering Co., Fred H. 158
Servel, Inc. *
Skidmore Pumps *
Skil Corp. 156
Smith Co., Inc., H. B., The *
Spang-Chalfant Div. of The National Supply Co. 157
Spence Engineering Co., Inc. 48
Spencer Heater, Avco Mfg. Corp. *
Sporlan Valve Co. *
Spraying Systems Co. *
Standard Stamping & Perforating Co. *
Stedco Products 212
Stephens-Adamson Mfg. Co. *
Sterling Electric Motors *
Sterling, Inc. *
Stewart Mfg. Co. *
Stic-Klip Mfg. Co. 211
Superior Combustion Industries, Inc. *
Surface Combustion Corp. 191
Swartwout Co. *
Swift & Co. *

Taco Heaters, Inc. 46
Taylor Forge & Pipe Works 24
Taylor Instrument Cos. 207
Thrush & Co., H. A. 28
Titus Mfg. Corp. 21
Titusville Iron Works Co., The, Div. of Struthers Wells Corp. *
Trane Co., The 12 & 13
Trerice Co., H. O. *
Trindl Products, Ltd. 210
Truscon Steel Co. *
Tube Turns, Inc. 45
Tuttle & Bailey, Inc. *
Typhoon Air Conditioning Co., Inc. 155

Union Asbestos & Rubber Co. 174, 175
Unistrut Products Corp. *
United Cooling Tower Co. *
United Electric Controls Co. 209
United States Air Conditioning Co. 3
United States Gauge Div., American Machine & Metals, Inc. *
United States Steel Co. 18, 173
United States Steel Co. (U. S. Supply) 18
Universal Diffusers Corp. *
Utility Appliance Corp. *

Vernon Tool Co., Ltd. 208
Vulcan Radiator Co. *

Wagner Electric Corp. 44
Waldron Corp., John *
Walworth Co 197
Ward Leonard Elec. Co. *
Water Cooling Corp. *
Waterman Waterbury Co., The *
Watson-Stillman Fittings div., H. W. Ported & Co. 33
Webster & Co., Warren 67
Webster Engineering Co. *
Weil Pump Co. *
Weksler Thermometer Corp. 196
Welding Fittings Corp. 6
Western Engineering & Mfg. Co. 212
Westinghouse Electric Corp., Air Conditioning Div. *
Westinghouse Electric Corp. *
Westinghouse Electric Corp., Sturtevant Div. 42
Weston Electrical Instrument Corp. *
Wheatland Steel Products Co. *
Wheeler Mfg. Co., C. H. 151
White-Rodgers Electric Co. *
Whitlock Mfg. Co. *
Wiegand Co., Edwin L. 208
Will-Burt Company, The 154
Williams Valve Co., D. T., Div. of The Schaible Co. *
Wilson & Co. 205
Wilson, Inc., Grant *
Wing Mfg. Co., L. J. *
Wolverine Tube Div. of Calumet & Hecla, Inc. 43
Worthington Corp. 38

Yarnall-Waring Co. 27
York Corporation *
York-Shipley *
Young Radiator Co. *
Youngstown Sheet & Tube Co. 36

Zallea Bros. 199
Zink Co., John, 29
Zonolite Co. *
Zurn Mfg. Co., J. A. *

Firms represented in this issue are identified by the folio of the page on which their advertising appears. Advertising which appears in other issues is marked with an asterisk.

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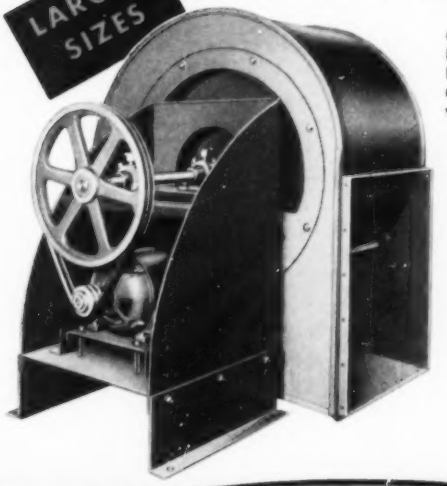
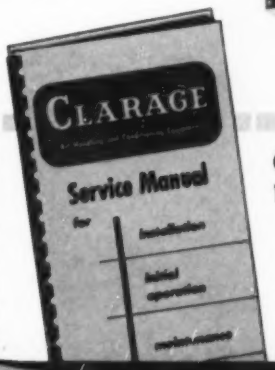


Cut at left shows standard Ready Unit as built in three largest sizes. These larger units, too, can be equipped with Outdoor Covers.



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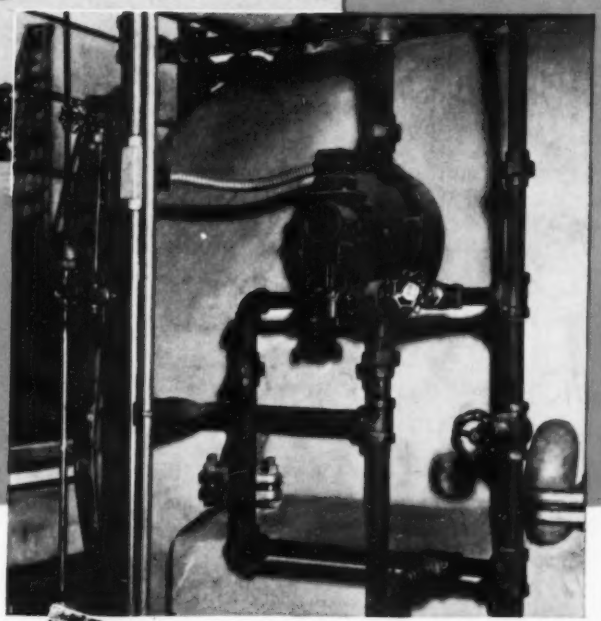

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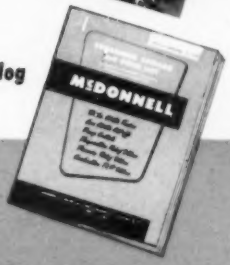

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